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# THE LARYNGOSCOPE.

VOL. XXXI ST. LOUIS, OCTOBER, 1921

No. 10

## ORIGINAL COMMUNICATIONS.

(Original Communications are received with the understanding  
that they are contributed exclusively to THE LARYNGOSCOPE.)

### STUDIES IN OTOTOLOGY—USING THE PITCH RANGE AUDIOMETER.\*

DR. L. W. DEAN, Iowa City, Ia.

Fellows of the American Laryngological, Rhinological and Otological Society. Gentlemen: Before opening the scientific session of this Society, I desire to thank you for the very great honor you have conferred upon me.

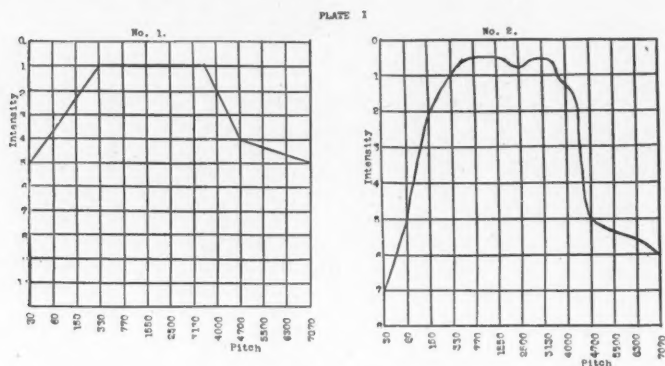
In preparing my address for this occasion it seemed best to me to talk about those things in which I have been particularly interested. My colleague, Mr. C. C. Bunch, has devised some excellent methods for the measurement of a part of the tonal range. These procedures have been used for the study and investigation of the cases in our otological service. While the results of these observations have not been revolutionary or of great practical benefit to otology, they have been of much scientific interest to us.

While the pitch range audiometer has been proven to be an important diagnostic aid in otology, its greatest use so far has been to study the variations of the tonal range within the limits of the machine. The clinical charts of our cases have been made more complete and exact by its use. The variations in the tonal range from 30 d.v. to 7070 d.v. are graphically illustrated and by repeated examinations as the disease progresses or improves, the retrogression or improvement has been demonstrated.

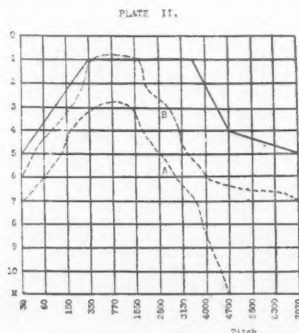
During the last year our plan has been to select a number of cases of a certain otological condition. Each case was conscientiously ex-

\*President's Address, American Laryngological, Rhinological and Otological Society, Atlantic City, June 3, 1921.

amined and the results compared. When it seemed desirable, defects in the tonal ranges indicated by the audiometer were confirmed with the tuning forks. The examinations were made by Mr. Bunch or under his supervision. The usual otological examination, including the functional examination of the cochlear apparatus, was carried out in every case. When indicated the function of the vestibular mechanism was also determined.



Normal Curves. No. 1. Normal of Audiometer used up to Sept., 1920. No. 2. Normal with new Audiometer.



L.W.D. Curves before and after the removal of impacted Wax from external canal. Right. A. Curve before removal of wax. B. Curve after removal of wax. Voice. Before Wh. 3 ft. Sp. 15 ft. After Wh. 15 ft. Sp. 45 ft. Upper limit. Before removal Monochord, A.C. Much diminished. B.C. Normal. c5 (4090 d.v.) fork not heard by A.C.

This gave us for each diseased condition selected a number of charts representing the tonal range as determined by the audiometer. In each instance the charts made by examination of individuals with the same disease were strikingly similar. Also noteworthy was the

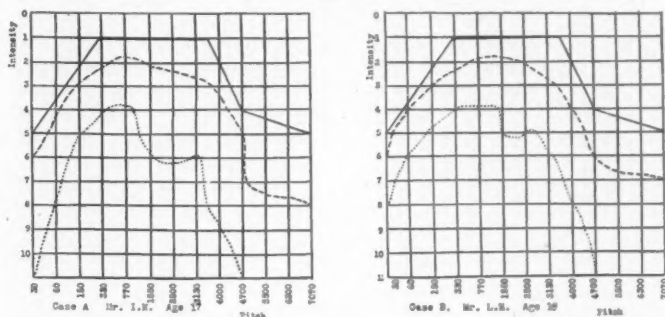


similarity of the curves when a given structure was involved by different pathological processes. For example, the curves showing involvement of the cochlea in syphilis, splenic leukemia, from traumatism, oto-sclerosis, or when secondary to middle ear disease are similar.

Later in the session, Mr. Bunch will demonstrate his apparatus for measuring the tonal range, so no description of it will be given at this time.

We should, however, get a clear conception of just what the normal curve on the chart represents.

PLATE III.



Case A. Mr. I. M. Age 17. Case B. Mr. L. H. Age 18. Showing effect of packing external auditory canal with boric acid powder. -----Curve before packing canal with boric powder. ....Curve after packing canal with boric powder. Note that Case A shows the same interference with tones above 4000 d.v. as is shown in the case of impacted wax. Upper limit. Monochord. A. B. Before packing A.C. 19000 B.C. 20000 A.C. 19000 B.C. 20000. With external canals closed A.C. 17000 B.C. 20000 A.C. 17000 B.C. 20000.

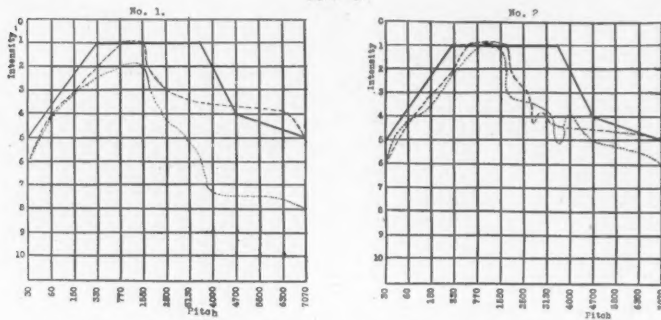
Plate I shows two curves of normal hearing for the two different types of audiometers. The second curve is for the one installed in September and has been in continual service since.

The figures at the bottom of the chart indicate the range of frequencies that are produced. The numbers at the left indicate the intensities, faint tones being produced on step 1 and the louder ones toward the bottom of the chart. For convenience we have indicated the curve for the right ear by a line of dashes, and that for the left by dotted lines.

The curves are only tentative. The two normal curves are different because the two machines are different in construction. Just as in perimetry of the eye, the perimetric figure is compared to the normal visual field, so here the curve of the patient examined is compared to the normal curve and defects noted.

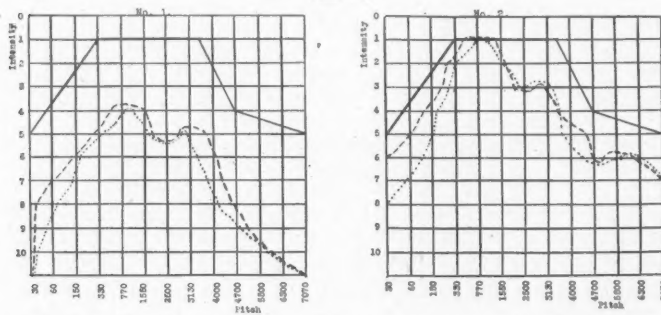
To secure the curve for the patient a mark is made on the chart showing at just what intensity each note from 30 d.v. to 7070 d.v. is heard. These marks, when joined, constitute the curve representing the hearing of the patient examined. The curve thus secured when compared with the normal curve for the machine represents graphically the defects in the tonal range of the audiometer if any are present.

PLATE IV.



Mr. R. D. Age 29. No. 1. Cotton in Left Ear. No. 2. After removal of cotton, Left. Diagnosis: Plug of cotton in Left External Canal. Voice: (Before Removal) Normal. Showing range of voice from about 500 d.v. to 1500 d.v. practically normal in curve No. 1.

PLATE V.



Mr. C. C. Age 15. Diagnosis: Acute Tubal Catarrh. Voice: Curve 1 R Wh. 9 ft. Sp. 16 ft. L Wh. 6 ft. Sp. 15 ft. Curve 2 (After Inflation.) R Wh. 15 ft. Sp. 45 ft. L Wh. 15 ft. Sp. 45 ft.

Mr. Bunch determined the normal curve in the following manner: a group of students in advanced psychology and the adolescents and young adults in our service who were known to have clinically normal hearing were tested. As the result of the tests, some twenty-five in number, our working normal was determined. From the

charts which follow it will be seen that this curve was often surpassed in different portions of the range, but this in no way detracted from its value as a comparative standard.

Plate II. Curve of right ear before and after the removal of impacted wax from its external auditory canal.

Note that while there is an interference with the audition of all notes within the range of the audiometer, the diminution is more marked in the upper part of its range from about 4000 d.v. to 7070 d.v. Note the sudden descent in the curve from 4000 d.v. to 4700 d.v., indicative of the diminution of audition for notes in this part

PLATE VI.

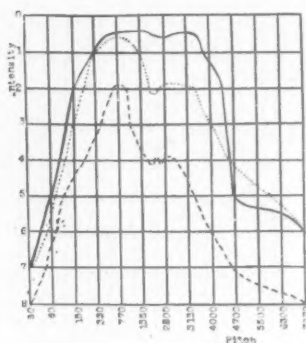


PLATE VI.

Mr. R. H. Age 18. Diagnosis: Adenoma of the Fossa of Rosenmüller, Right, blocking Eustachian Tube. Drum Membrane, Right, much retracted. Voice: R Wh. 12 ft. Sp. 30 ft. L Wh. 15 ft. Sp. 45 ft. Galton Whistle R 19000 L 23000. Koenig Cylinders R 19000 L 21000. Monochord R A.C. 17000 B.C. 18000. L A.C. 19000 B.C. 21000.

PLATE VII.

Miss C. H. Age 18. Diagnosis: Chronic Hyperplastic Otitis Media, Mild Type. Voice: R Wh. 15 ft. Sp. 45 ft. L Wh. 15 ft. Sp. 45 ft. Galton Whistle R 22000 L 22000. Koenig Cylinders R 40960 L 40960. Monochord: R A.C. 19000 B.C. 20000. L A.C. 20000 B.C. 20000. Note that audition for tones above 400 d.v. is normal.

of the range. C<sup>5</sup> fork (4096 d.v.) is not heard by A.C. The audition of the notes from 7070 d.v. to the upper tone limit by A.C. is much diminished. The upper limit by A.C. as measured by the monochord is much lowered, while by B.C. it is normal.

After the removal of the wax the C<sup>5</sup> fork is heard at the normal distance and the upper limit by A.C. is normal. After the removal of the wax the audiometer curve (the upper one in the chart) approaches the normal.

Plate III shows curves secured in two cases before and after packing the external auditory canal with boric acid powder. The curves

with the dashes are the audiometer curves secured before the introduction of the boric acid powder; the ones with the dots are made after its introduction.

The same interference with audition for notes in the upper part of the range of the audiometer was noted as in the case of impacted wax. The upper limit of the tonal range as detected with the monochord by A. C. was lowered by the introduction of the powder into the canal while the upper limit by B.C. was not changed.

Plate IV shows the curves of a soldier recently returned from France. His only complaint was continuous distressing tinnitus in

PLATE VIII.

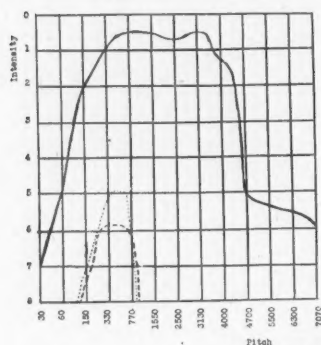


PLATE IX.

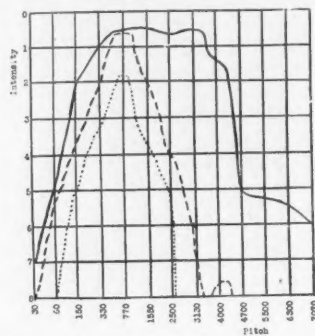


PLATE VIII.

Mrs. W. Age 30. Diagnosis: Chronic Hyperplastic Otitis Media with Involvement of the cochlea following discharging ears at age of three years. Voice: Each, only loud voice, no words. B.C. c R-3 sec. (?) L-4 sec. (?) c2 decreased 10 sec. in both. Monochord not heard by B.C. A.C. No high tones heard. Whistles (Loud) heard to a2. Forks 50 d.v. c c1 c2 c3 c4 c5. R 0 0 1/14 4/18 0 0 0. L 1/2 1/10 2/14 2/18 0 0 0.

PLATE IX.

Mr. H. A. Age 47. Diagnosis: Blocking of each Eustachian Tube by an Ulcerating Malignant Growth in the Naso-Pharynx resulting in an acute serous catarrh of the middle ear. Voice: R Wh. 15 ft. Sp. 45 ft. L Wh. 2 ft. Sp. 6 ft. Forks 50 d.v. c c1 c2 c3 c4 c5. R 2/4 4/8 8/12 12/18 20/24 24/48 1/120. L 1/8 1/8 2/12 3/18 6/24 12/48 1/180. Monochord R A.C. 12000 B.C. 18000. L A.C. 12000 B. 18000. Note the tone gap in the right.

the left ear. Hearing right and left S.V. 45 ft. W. 15 ft. A little bit of cotton was found in the left ear. It was removed with the disappearance of the tinnitus. Note that the curve No. 1 for the left ear shows normal audition for notes from 500 d.v. to 1500 d.v., the range of the human voice, while we have the same diminution in audition for notes in the upper part of the audiometer range as in the cases of impacted wax and boric acid powder in the external auditory canal. With the removal of the cotton the curve for the left ear became practically normal.

We have found some difficulty in securing curves of middle ear diseases without involvement of the inner ear. Our observations would tend to confirm Emerson's statement regarding the frequency of cochlear involvement in middle ear disease. The following three curves represent the condition in three cases that were in our judgment cases of pure middle ear disease.

I trust that no observation that I report today will be considered definite. I am reporting this work hoping it will be of interest to you and that perhaps some of these things will be worthy of your further consideration. Our work on the middle ear diseases has

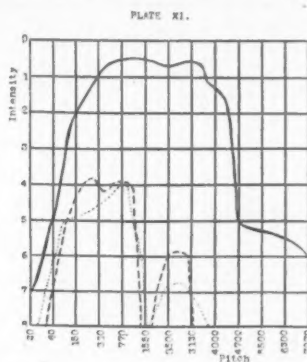
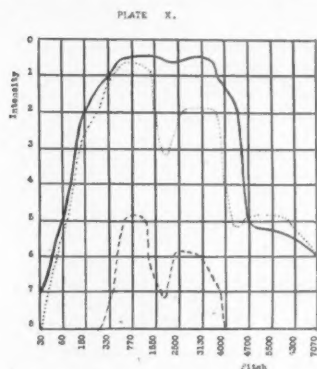


PLATE X.

Miss I.W. Age 27. Diagnosis: Chronic Hyperplastic Otitis Media with Cochlear Involvement. Voice: Wh. R 0. Sp. 2 ft. Wh. L 15 ft. Sp. 45 ft. B.C. R-5 sec. L-2 sec. Galton Whistle R 14500 L 17500 Koenig Cylinders R 30720 L 30720. Monochord R A.C. 12000 B.C. 16000. L A.C. 15000 B.C. 16000.

PLATE XI.

Mr. S. D. Age 15. Diagnosis: Chronic Hyperplastic Otitis Media with Involvement of the Cochlea. Voice: R Wh. 1 ft. Sp. 5 ft. L Wh. 1 ft. Sp. 3 ft. B.C. Decreased 2 sec each ear. (c2 fork). Forks 50 d.v. c c1 c2 c3 c4 c5. R 3/4 3/4 4/8 6/12 0/24 0/48 0/60. L 3/4 3/4 5/8 8/12 0/24 0/48 0/60. Monochord R A.C. 17000 B.C. 20000. L A.C. 17000 B.C. 20000. Galton Whistle R 21000 L 21000. Koenig Cylinders R 43960 L 40960.

been particularly unsatisfactory. It is our plan to devote much of our time during the coming year to this subject. Mr. Bunch hopes to have a machine that will test all tones from 7000 d.v. to the upper limit. Such a machine should give some interesting information regarding the early involvement of the cochlea in middle ear diseases.

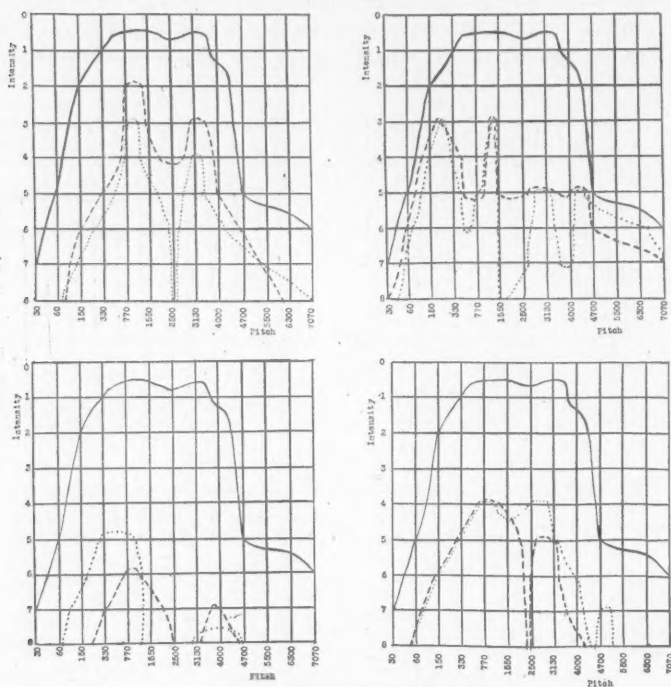
In the cases which are shown, the curves were not used for diagnostic purposes. The clinical diagnosis was made and then the curve of the case secured.

Plate V shows curves of acute tubal catarrh before and after inflation of the middle ear. The first curve shows a uniform diminu-

tion in the audition of all notes within the range of the audiometer except the very low notes. The audition for these is much more diminished, 30 d.v. not being heard at the greatest intensity in either ear.

After inflation the hearing for whisper and spoken voice which had been diminished became normal and the audiometer curves close-

PLATE XII.



Diagnosis: Otosclerosis.

ly approach the normal. Naturally if any diminution of hearing within the range of the audiometer was due to cochlear involvement, it would not be improved by inflation. We consider the decreased audition for the higher notes within the range of the audiometer in this case to be due to the middle ear lesion.

Plate VI. The eighth Eustachian tube was blocked by an adenoma in Rosenmüller's fossa. The right tympanic membrane was much retracted. Note the rather uniform diminution in audition for the

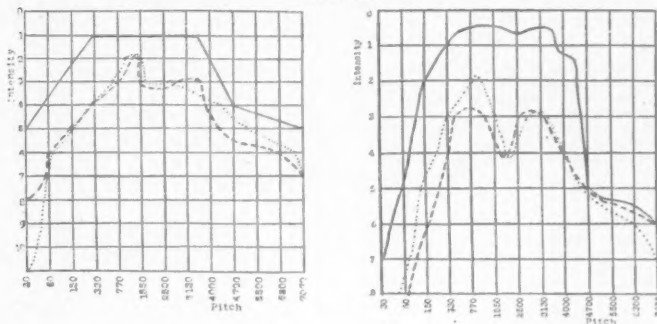


notes within the range of the audiometer. The upper limit by B.C. with the monochord was 18000, practically normal.

Plate VII. This shows the curves of a mild case of chronic hyperplastic otitis media in each year. Note that audition for notes in the lower one-half of the range of the audiometer, *i. e.*, from 30 d.v. to 4000 d.v. is uniformly diminished, while that from 4000 to 7070 is normal, quite different from the curve of the case of cotton in the external auditory canal. In each case the hearing by voice and whisper tests was the same.

Plate VIII illustrates the curves for the right and left ears in a case of marked chronic hyperplastic otitis media with cochlear de-

PLATE XIII



Miss F. D. Age 25. Diagnosis: Otosclerosis. No. 1 July 15, 1919. Voice: R. Wh. 30 ft. Sp. 60 ft. L. Wh. 25 ft. Sp. 60 ft. Curve almost normal. Low notes, Left, Poor. Slight partial gap at about 1700 d.v. No. 2. April 6, 1921. Voice R. Wh. 4 ft. Sp. 15 ft. L. Wh. 8 ft. Sp. 24 ft. Low notes much poorer. Partial gap deeper. High notes normal.

generation. With the audiometer notes are heard only from 100 d.v. to 800 d.v., B.C. decreased ten seconds in each ear for the C<sup>2</sup> (512 d.v.) fork, and the monochord not being heard by B. C. indicates clinically the involvement of the inner ear.

Plate IX. Curves of a case of acute serious catarrh of the middle ear due to blocking of and inflammation of the Eustachian tubes by an ulcerated carcinoma of the left tubal orifice and lateral wall of the nasopharynx. Note the sudden drop in the curve about the middle of the range of the audiometer; in the left ear at about 2500 d.v. and in the right a little higher. Also note the tone gap from 3200 to 3400 d.v. in the right. From a study of our cases of cochlear involvement in middle ear lesions we conclude that the cochlear involvement is indicated when there is a diminution of the hearing power for high notes more marked than for the low, and

PLATE XIV

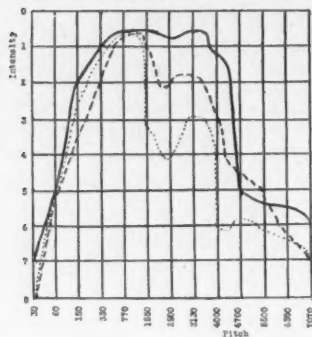


PLATE XV

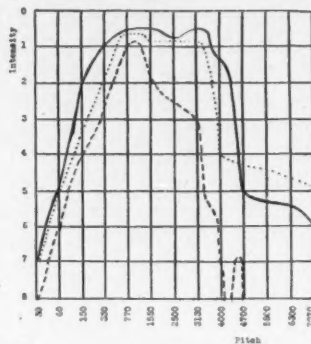


PLATE XIV.

Mr. C. V. Age 18. Diagnosis: Acute Suppurative Otitis Media from Tubal Infection while in swimming. Bilateral. Voice R Wh. 4 ft. Sp. 36 ft. L Wh. 15 ft. Sp. 45 ft. Forks 50 dv. c c1 c2 c3 c4 c5. R 4/4 8/8 10/12 16/18 22/24 40/48 50/60. L 3/4 8/8 10/12 16/18 22/24 30/48 4/60. Galton Whistle R 21000 L 21000. Koenig Cylinders R 40960 L 40960. Monochord R A.C. 17000 B.C. 18000 L A.C. 17000 B.C. 18000. Note that both forks and audiometer show a decrease in the left for the tone c5 (4096 dv.).

PLATE XV.

Mr. J. S. Age 20. Diagnosis: Acute Suppurative Otitis Media with Acute Mastoiditis, Right. Left, Normal. (Curve taken 13 days after Mastoidectomy, Right.) Note the gap suggesting involvement of the cochlea.

PLATE XVI

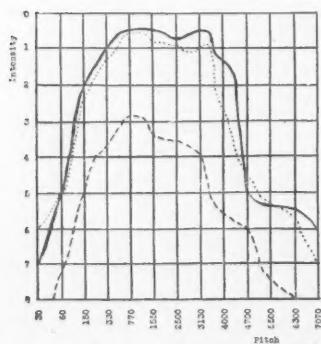


PLATE XVII.

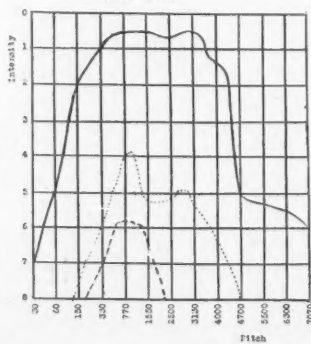


PLATE XVI.

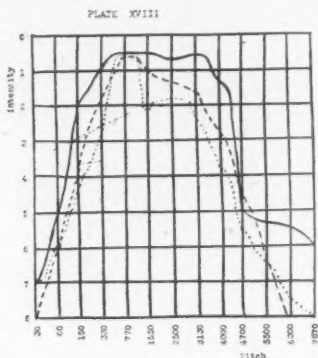
Miss A. E. Age 15. Diagnosis: Chronic Suppurative Otitis Media, Right. Voice R Wh. 3 ft. Sp. 6 ft. L Wh. 15 ft. Sp. 45 ft. B.C. Right and Left, Increased (c2 fork). Koenig Cylinders R 43960 L 43960. Monochord R A.C. 17000 B.C. 17000. L A.C. 19000 B.C. 19000.

PLATE XVII.

Mr. T. G. Age 14. Diagnosis: Chronic Suppurative Otitis Media with Cochlear Involvement. Voice: R Wh. 0 ft. Sp. 6 in. L Wh. 1 ft. Sp. 3 ft. Koenig Cylinders R 30720 L 32768. Galton Whistle R 11000 L 14000. Monochord R A.C. 9000 B.C. 14000. L A.C. 9000 B.C. 15000.

especially when there is indicated a sudden drop in the curve indicating marked diminution for audition of the higher notes of the range of the audiometer or when tone gaps or deep depressions in the curve, partial tone gaps, are present. The cases with curves showing either of these conditions usually have the upper limit lowered by B.C. when tested with the monochord. This does not happen to be the case in this instance. In inner ear lesions the upper limit by A.C. and B.C. may be normal.

Plate X. Chronic hyperplastic otitis media with cochlear involvement showing partial tone gap in the curve for each ear.



Miss B. F. Age 7. Diagnosis: Chronic Suppurative Otitis Media with Perforation of Schrapnell's Membrane. Right. Voice R Wh. 10 ft. Sp. 30 ft. L Wh. 15 ft. Sp. 45 ft. Forks 50 dv. c c<sup>1</sup> c<sup>2</sup> c<sup>3</sup> c<sup>4</sup> c<sup>5</sup> R 3/4 6/8 10/12 16/18 20/24 34/36 60/60. L 4/4 8/8 12/12 18/18 24/24 36/36 60/60. Koenig Cylinders R 43960 L 43960. Monochord R A.C. 18000 B.C. 18000. L A.C. 19000 B.C. 19000. (Note that the curves are almost normal.)

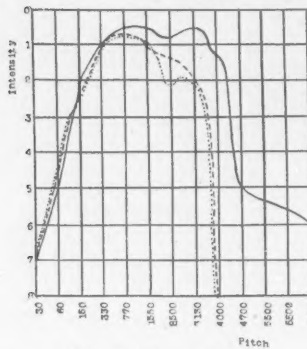
Plate XI. Chronic hyperplastic otitis media with involvement of the cochlea showing the sudden drop in the curve for each ear at about 3000 d.v. and the presence of a tone gap in each ear, the gap being wider in the curve for the right ear than in that of the left.

Plate XII shows the curves for the right and left ear in four typical cases of otosclerosis. Note the complete and partial tone gaps; also the marked diminution of audition for the notes from 30 to 40 d.v. in each case. Note the difference in the audition of the higher notes of the audiometer range in the case of Miss L. S. and that of Mr. T. T.

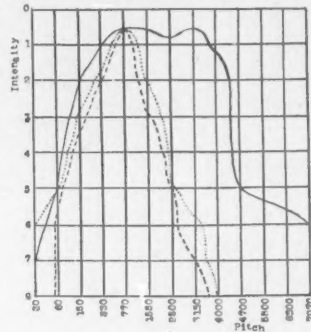
During the last nine months nine typical cases of otosclerosis were studied. In every case the right or left ear or both showed complete gaps in the audiometer curve. Of the eighteen ears examined, twelve, or 66 $\frac{2}{3}$ %, showed complete gaps.

Plate XIII shows a case of otosclerosis with curves made on July 18, 1919, and a second on April 6, 1921. This was not one of the cases included in the nine typical ones studied. When first seen the only complaint was tinnitus. Hearing rt. W. 30 ft., S.V. 60 ft.; lt. W. 25 ft., S.V. 60 ft. A diagnosis of otosclerosis was made. The first curve was almost normal. Audition for the lower notes

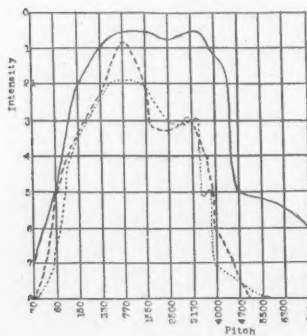
PLATE XIX.



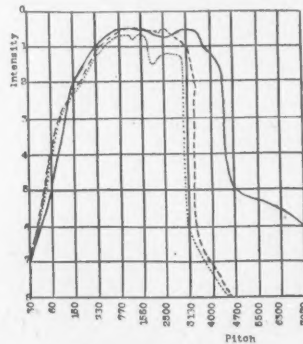
Mr. W. S., Age 26.  
Cause: Diseased Tonsils.



Mr. J. T., Age 47.  
Cause: Cerebro-spinal Syphilis.



Mrs. M. B., Age 50.  
Cause: Cerebro-spinal Syphilis.



Mr. S., Age 30.  
Cause: Tonsils.

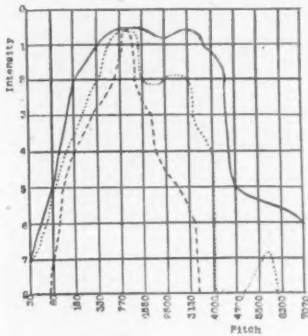
Diagnosis: Acoustic Neuritis.

left was poor. There was a very slight partial gap at about 1700 d.v.

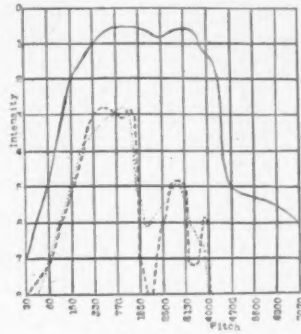
The second curve, taken about twenty-two months later, showed the progress of the disease. Hearing was rt. W. 4 ft., S.V. 15 ft.; lt. W. 8 ft., S.V. 24 ft. The audition for the low notes is much poorer. The partial gap is deeper. The audition for the higher notes of the audiometer range is normal.

Plate XIV shows the curves of a case of acute suppurative otitis media right and left from tubal infection while in swimming. These curves were taken just a few days after the infection developed. Both curves show diminution for the audition of 30 d.v. The sudden drop in the curves about 1500 d.v. and 4000 d.v., together with the partial tone gaps, are suggestive of each cochlear involvement. These conditions are most marked in the left ear. By both tuning

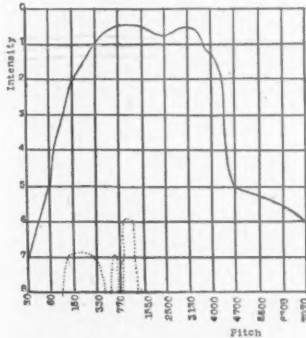
PLATE XX.



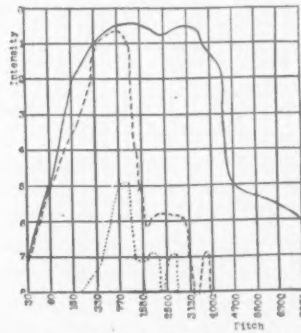
Mr. W. W., Age 41.  
Cause: Syphilis.



Mr. N., Age 17.  
Cause: Mumps.



Mr. J. D., Age 27.  
Cause: Meningitis.



Mr. H., Age 30.  
Cause: Influenza.

Diagnosis: Neuro-Labyrinthitis.

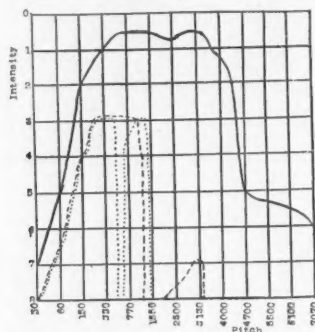
fork and audiometer the audition for 4096 d.v. is much decreased in the left.

Plate XV shows the curves of a case of an acute otitis, right, that required a mastoidectomy. Again the sudden descent of the curve and the tone gap suggests involvement of the cochlea.

Plate XVI shows the curves of a case with chronic suppurative otitis media, right. The curve of the right ear shows a uniform diminution in audition for all tones within the range of the audiometer. There is nothing in the curve indicating cochlear involvement. The lowering of the upper limit by A.C. and B.C. suggests an involvement of the cochlea. Probably the part of the cochlea involved is concerned in receiving sound vibrations that are above the upper limit of the audiometer.

Plate XVII shows curves of a case with chronic suppurative otitis media, right and left, with cochlear involvement. The sudden drop

PLATE XXI.



Mr. S. H. Age 63. Diagnosis: Neuro-Labyrinthitis from Pellagra. Voice R. Wh. 6 in. Sp. 2 ft. L. Wh. 6 in. Sp. 6 ft. Galton Whistle R 14000 L 14000. Koenig Cylinders R 30720 L 30720. Monochord R A.C. 14000 B.C. 14000. L A.C. 13000 B.C. 15000. This curve suggests the influence of metabolic disturbances on the organ of hearing.

in the curve for each ear indicates the inner ear lesion. The upper limit in each ear is much lowered by A.C. and B.C.

Plate XVIII shows the curves of a case of chronic suppurative otitis media with perforation of Shrapnell's membrane, right. Left ear normal. Note that the curve for the right ear is practically normal except for the low notes. The tuning fork tests confirm the curve. There is nothing in the curve or the clinical examination indicating a lesion of the inner ear.

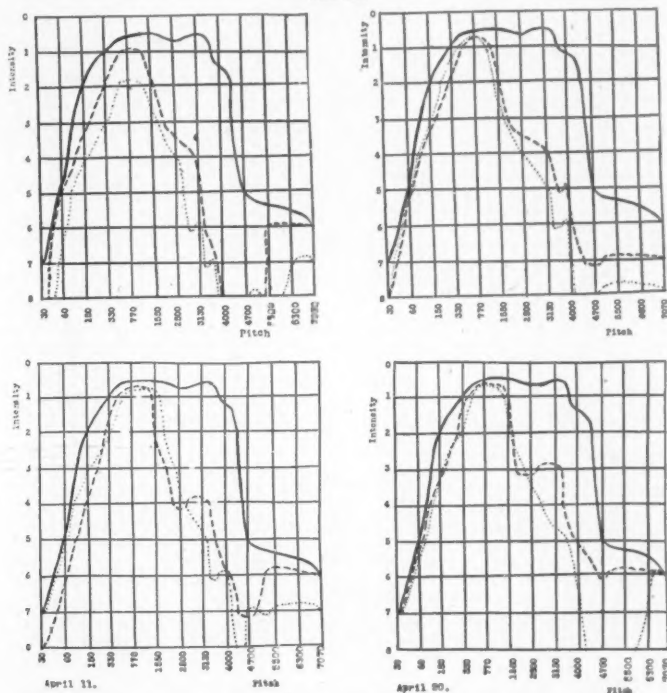
Plate XIX illustrates the curves of four cases of acoustic neuritis. I realize the difficulty in making a diagnosis between nerve and labyrinth lesions and we should rather consider these curves as representing cases presenting the following condition: hearing for whisper and voice fairly good or normal, B.C. much diminished, upper limit lowered by A.C. and B.C., no history of vertigo, vestibular reactions normal: the disease has been very slow in develop-



ing. Note in each instance the sudden descent of the curves in the upper part of the range for the audiometer. It is interesting to watch the return of the curves to normal when the lesion is secondary to a focus of infection in the tonsils and the tonsils have been removed.

Plate XX illustrates the curves of four cases of neuro-labyrinthitis. In each case the hearing and the vestibular reactions were diminished.

PLATE XXII



Diagnosis: Neuro-Labyrinthitis, Tuberculous (?). Curves show improvement with the use of small doses of new tuberculin subcutaneously.

Syphilis, mumps, influenza, and meningitis were the etiological factors. Note the sudden descent of the curves and the tone gaps similar to the findings in the cochlear lesions already exhibited.

Plate XXI illustrates the curves of a case of neuro-labyrinthitis from pellagra. The curves are similar to the curves of cases of neuro-labyrinthitis just demonstrated. The curve is interesting in that it illustrates the influence of a disease that is probably due to metabolic disturbances may have on the inner ear.

Plate XXII shows the changes in the curves of a case of neuro-labyrinthitis, probably tuberculosis, that improved with the injection of very small doses of new tuberculin subcutaneously. The curve of the right ear indicates the greater improvement. The gap from 4000 to 5000 d.v. has disappeared and the curve is higher in the upper part of the range.

Plate XXIII shows the curves of a case of deafness in splenic leukemia. There was no history of vertigo. Vestibular reactions normal.

Plate XXIV shows the curves of the left ear in a patient with hysterical deafness. A curve was taken before any treatment was

PLATE XXIII.

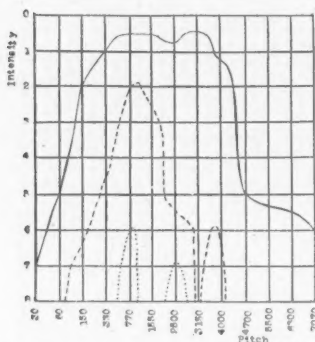
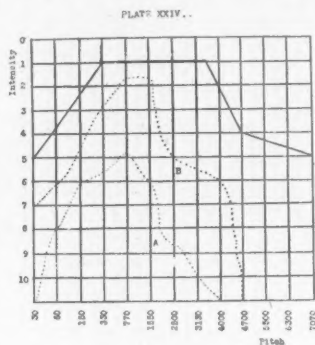


PLATE XXIII.

Mr. Wm. E. Age 60. Diagnosis: Leukemic Deafness. Voice: R Wh. 8 ft. Sp. 45 ft. L Wh. 0 ft. Sp. Loud voice close to ear. Forks 50 d.v. c c1 c2 c3 c4 c5. R 1/4 2/8 2/16 12/24 10/36 30/48 2/60. L 0 0 0/16 0/24 0 0/48 0. Galton Whistle R 12000 L 10500. Koenig Cylinders R 27306 L 27306. Monochord R A.C. 7000 B.C. 14000 L A.C. 7000 B.C. 12000.

PLATE XXIV.

Mrs. B. Q. Age 34. Diagnosis: Hysterical Deafness. (Left) Curve A. Before electrical treatment with suggestion. Curve B. After treatment. Voice Before treatment Whisper 1 ft. Spoken 2 ft. After treatment Whisper 15 ft. Spoken 45 ft. (On discharge, all tones normal except for decrease in tones above 4000 d.v.)



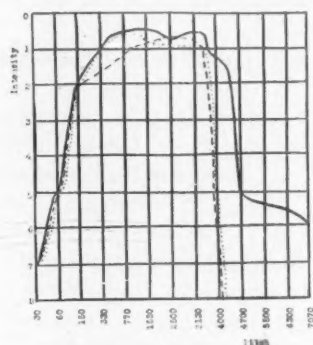
instituted. The curve is somewhat similar to the concentric contracted perimetric field in hysterical amblyopia. After suggestion, with hearing for voice and whisper normal, the curve approached the normal B. It is interesting to note that after the patient considered herself cured, the audition for notes in the upper part of the range of the audiometer did not become normal. I am under the impression that there are also sometimes permanent defects in the perimetric fields in hysterical patients.

Plate XXV. In our clinic we are accustomed to represent the audition of a patient for a given tuning fork by a fraction, the

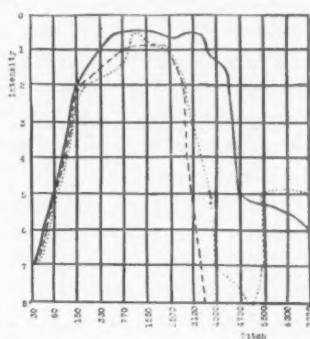
numerator expressing the distance the patient hears the fork vibrating from a given impulse and the denominator representing the distance at which the examiner hears it. When the assistants in the clinic have normal hearing for voice and whisper, their comparative results have formed a part of the clinical chart of our cases.

The six assistants at present in the clinic were tested with the audiometer. Two of the six had defective curves. In the case of Dr. N., the audition of notes from 4000 to 7070 d.v. was diminished; in the case of Dr. S., from 4000 to 5500 d.v. Testing these men with the C<sup>5</sup> fork confirmed this defect. Consequently all observations made by these examiners using the C<sup>5</sup> fork were not reliable and the clinical charts of the cases examined by them were defective. It is not unusual to find this type of curve in smokers. In the case of Dr. N., the upper limit by A.C. and B.C. was lowered. In the case of Dr. S., it was normal.

PLATE XXV.



Dr. N.



Dr. S.

## Curves of Assistants in Clinic.

No. 1. Notes above 3800 much decreased in both. Upper limit much lowered. (Galton and Monochord.)

No. 2. Notes above 3100 in right much decreased. Gap between 4000 and 5500. Upper limit normal.

Mr. Bunch tells me that Dr. J., a third assistant, who had a perfectly normal curve, developed a pneumonia since I left Iowa City, and since then has a defect in the upper part of the range of the audiometer.

It has been a source of regret to us that we have not had opportunity to autopsy any case which has furnished an interesting audiometer curve. Only after cases have been tested with the audiometer and a careful post-mortem study has been made of the organ of hearing we will have conclusive evidence as to the significance of the defects in the audiometer curves.

**DEMONSTRATION OF THE IMPROVED METHODS OF  
MEASURING THE TONAL RANGE, SHOWING  
PROGRESSIVE DEVELOPMENT OF  
THE APPARATUS.**

DR. C. C. BUNCH, Iowa City, Iowa.

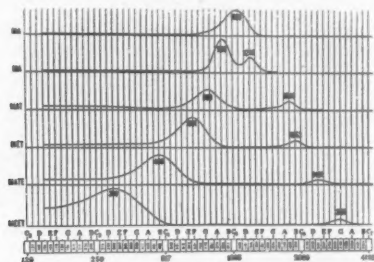
The work which I have been called upon to report to you has been carried on more or less intensively for the past four years at the State University of Iowa. During this time the limits and possibilities of part of our apparatus have been fairly well defined and the significance of the application to clinical diagnosis has been shown by your president, Dr. Dean, in his address. The immense amount of work remaining to be completed from the clinical viewpoint, as well as mechanical construction, leads us to feel that the problems are little more than touched.

The writer wishes in advance to state that he is very greatly indebted to several departments in the State University for their hearty co-operation and assistance. Prof. A. H. Ford, of the Department of Electrical Engineering, and Prof. C. W. Hewlett, of the Department of Physics, have generously assisted in the design and the construction of the apparatus. Prof. C. E. Seashore, of the Department of Psychology, has given the full facilities of his laboratory and as Dean of the Graduate College, has been instrumental in securing financial aid. Last, but by no means least, Dr. L. W. Dean has spent much time in the analysis of results from a diagnostic viewpoint and has been a source of constant encouragement.

A brief survey of the problem and the principles involved may perhaps be significant at this point. It appears from the otological literature that since Bezold presented his continuous tone series of forks and whistles to the medical world, that there has been little advance in qualitative and quantitative measurements of the acuity of hearing. Regardless of the fact that today many clinical examiners possess the continuous tone series, or some similar set of tuning forks, we find that functional examinations are, as a rule, limited only to measurements of the octaves, usually five, and the determination of upper limit with the Galton whistle. If the examiner uses the method described by Bezold, the forks are struck with the "hardest blow" and the acuity of hearing of the patient is recorded as a fraction, the numerator being the perception time of the

patient and the denominator that for the normal ear. Others more pressed for time record these measures in terms of distances. The chief objection of the otologist to either of these methods lies in the fact that they require too much time and even when most carefully given are only approximations. The greatest error in these examinations, from a scientific standpoint, lies in the fact that they include only a limited portion of the hearing range. Tests of acuity for five or seven forks, for tones between 16 v.d. and 4096 v.d., reveal the sensitivity for only these five or seven widely spaced portions of the organ of hearing. Such examinations reveal nothing as to the sensitivity of the 4000 odd intermediate tones.

If I may quote Bezold again, "We have completely examined the hearing as soon as we know quantitatively the hearing for all tones," but a few sentences later he says: "There are, therefore, only pa-



—Plate I—Frequency of the Tones of Vowels, Science of Musical Sounds, Miller.

tients with the highest degree of deafness which require an examination with the whole sound scale." During the past year, records of our clinical examinations show that 43% of the cases tested show the presence of tone gaps in some portion of the range of hearing, *i. e.*, these patients are unable to hear certain of the loudest tones which we have been able to produce. This, to us at least, indicates that a more complete examination than is possible with the continuous tone series is necessary for differential diagnosis. In addition, the "hardest blow," which Bezold uses, is a widely varying factor. It has recently been shown in the University of Michigan that the energy of freely falling hammers may vary as much as 20%. When the human factor enters these computations the error must be much greater.

Tests of acuity for sounds of the voice, while of great significance to the patient, seem to add very little assistance in clinical diagnosis.





The range of tones covered is limited largely by the mechanical construction of the driving motor; in this case, the slowest speed available being two rotations per second, and the highest one hundred. The two electric generators (A and B, Plate III) consist each of two parallel plates, one fixed and the other attached to the shaft of the motor rotator. On the adjacent surfaces, at the circumference of these plates are matched teeth. On the larger pair are 150 teeth and on the smaller, fifteen. Between the pairs of parallel plates lie two coils (not shown in diagram), one of which carries the current from the standardizing battery and is for the purpose of producing a constant magnetization of the two plates. When the teeth of the similar plates are opposite each other, because of the small air space in the field (.008 in.), the magnetic flux through the plates

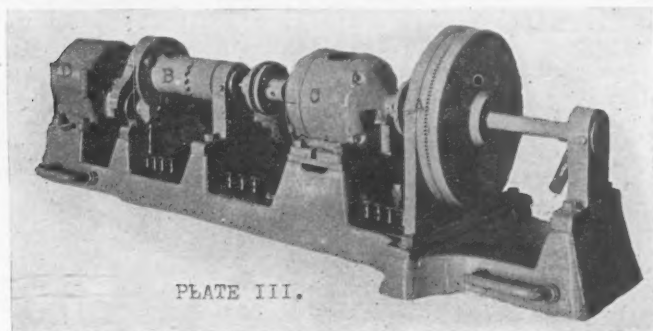


Plate III—Auriometer.

is at a maximum. When the wheel turns so that the teeth of the movable plate are opposite the spaces in the one which is stationary, this distance is increased to its maximum. Consequently the magnetic flux through the plates varies from a maximum to a minimum as rapidly as the teeth approach and recede from each other. This variation in magnetism induces an oscillating current in the other coil located between the plates. This one is in series with the telephone receiver. Since there are 150 teeth on the larger wheels, two rotations per second, the minimum speed of the motor will produce 300 oscillations per second. The fifteen teeth on the smaller wheels will give tones as low as 30 v.d. per second. With the two generators a range of tones from 30 v.d. to 15,000 v.d. is therefore available. A switch (E, Plate IV) is so arranged that the current from either generator may be led to the receiver, as desired.

The intensity of the sound in the receiver is regulated by a series of resistances, or more technically, by a potentiometer which varies the potential difference between the terminals of the telephone. These resistances are constructed on a purely arbitrary scale, the successive steps increasing 200%. (The terminals of the resistances are shown in Plate IV, C.) These steps were found to be smaller than was necessary in actual practice, so only alternate steps have been used, giving successive increases of 400% in the resistance of the circuit. It is not to be understood that these steps for any definite pitch give actual changes in the intensity of the sound of 400%. While it has been shown by many experimenters that the sound energy in a telephone is a linear function of the current passing through it, these steps are only relative and when we speak of intensity steps the expression only indicates the resistances which



Plate IV—Control Board.

regulate the current passing through the receiver. Actual determinations of intensity are scarcely necessary for such work, nor are they made in practice where values are indicated in the form of ratios.

The pitch of the tone is indicated by means of a frequency meter, or more accurately, by an electric tachometer, the dial of which is calibrated in terms of vibrations per second and attached to the control board (Plate IV). This tachometer is simply an electric speedometer similar to certain types used on automobiles or aeroplanes. The instrument is of standard design.

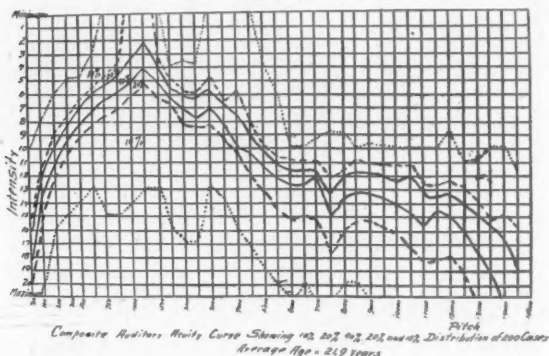
#### PROCEDURE.

The technic of testing is simple. The control board (Plate IV) is placed in a quiet room so that outside noises will not distract the attention of the patient. The telephone receiver is held at the ear

of the patient and he is instructed to indicate by some noiseless method that he hears the sound. For convenience we use an electric key and lamp (F, Plate IV) and the patient is instructed to press the key as long as he hears any sound. If a check on the results is desired, a switch leading to the telephone (E, Plate IV) is opened. If the patient still presses the key it is obvious that he is inattentive to instructions.

Two methods of making determinations are possible. One, which is very similar to that with the tuning forks, consists in adjusting the speed of the driving motor so that a certain fixed tone is produced. The intensity is then diminished until the sound becomes inaudible. This offers several advantages over the tuning forks.

Plate V.



It may be repeated for as many tones as the examiner desires. It gives accuracy and consistency impossible with the tuning forks. The results may be checked without loss of time. There is no long wait with a stop-watch to determine the time of dying out.

A new and more comprehensive method has been developed, one which is limited to instruments in which a tone of continuously changing pitch is available. By this method, the intensity is fixed and the pitch varied. When all the audible tones at a certain intensity step have been determined, the process is repeated for either louder or fainter steps in the same manner. As the tone gradually changes in pitch with the increasing or decreasing speed of the motor, should there be a loss in sensitivity for any of the tones produced, the patient will indicate this by raising the key. This may be verified by testing with either louder or fainter sounds, as desired. The records by this procedure are conveniently shown on a graph with

the pitch of the tones as the ordinates and the intensity steps as the abscissas. The points at which the observer begins or ceases to hear are indicated on this graph by dots. The process is repeated for each intensity step. At the close of the examination these dots are joined to show a curve which indicates the field of hearing.

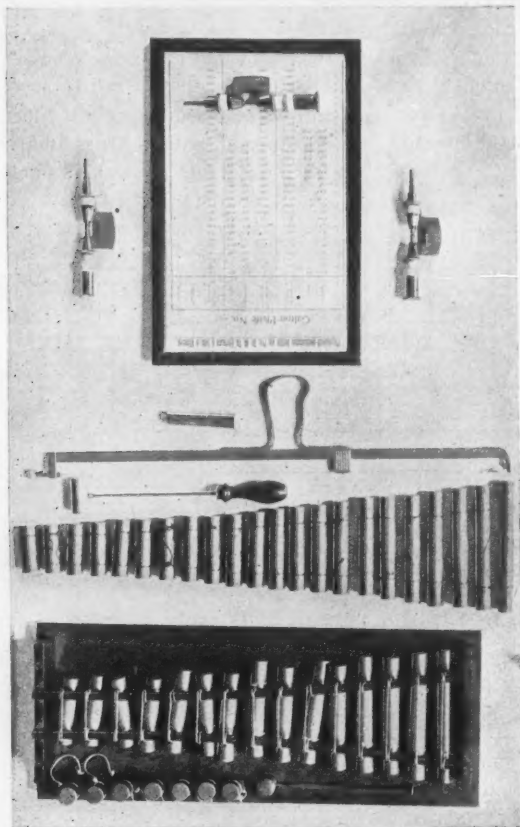


Plate VI—Instruments for Determining the Upper Limit of Hearing.

Comparison with that for normal hearing will show the exact location and extent of any loss or increase in sensitivity.

This method of testing offers many advantages over the fork test. First and most important, no tones are missed. Second, the results may be checked without loss of time and each trial at decreasing

intensities is an additional check on the louder ones. Third, a sound of continually changing pitch is attended to with a minimum of energy and fatigue to the organ. Fourth, the time consumed is much less than the old method. Concerning this point, the average time for a clinical test with the audiometer used during the past year has been fifteen minutes. If the mentality of the patient is below normal, or if the examination shows the presence of defects which need constant verification, the time mentioned is insufficient. The reliability of the test from the consideration of the response of the patient is certainly on a par with other functional tests of a similar nature.

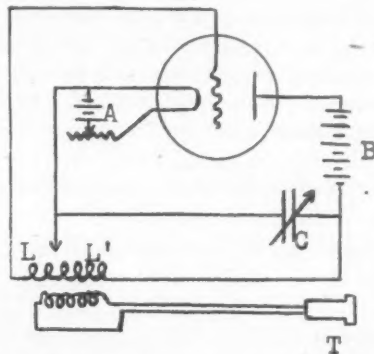


Plate VII—Set Up for Vacuum Tube for Producing High Frequencies.

The use of the telephone in tests of hearing is subject to criticism because of the variation in types of telephones. It is probable that no two receivers are identical. Our records with six receivers on a trained observer show variations indicated by at least one step in intensity at certain points in the scale. We found also that the same trained observer would give us variations as great as this with the same receiver due to fluctuations in attention and to physical condition. It seems desirable that for intensive work a normal curve for each receiver should be established and if practical to use the hand type of receiver rather than the watch-case type, because of its more substantial construction.

Another criticism of the telephone is due to the fact that it comes in contact with the head and the results must necessarily indicate to a certain extent a measure of hearing by bone conduction. According to physical laws it is probable that a portion of the energy may be transmitted in this manner. We find, however, that patients

who have increased bone conduction and decreased air conduction for the tuning forks do not show a greater sensitivity when the telephone is used because of this actual contact. It is probable that the conduction by contact is small, especially since the amplitude of the vibration of the diaphragm for a faint tone is of the order of the distance between the molecules of the iron of which the diaphragm is constructed. To eliminate this possible source of error we have attached a soft rubber cushion to the receiver so that there is no direct contact between the telephone and the head.

Our observations, because of the speed of the motor first available, have been limited to the range between 30 v.d. and 7070 v.d. In the Psychological Laboratory of the State University of Iowa, Mr. B. F. Zuehl, with an instrument somewhat different in construction, has conducted a series of examinations with two hundred observers over the range between 30 v.d. and 14,500 v.d. As shown in Plate V, he finds that the observers lie readily in several groups. These are indicated in the chart in groups of 10, 20 and 40%. Twenty-two intensity steps were used to get small differences and the individual tests lasted thirty minutes.

A brief examination of the curve shows that the most significant part of the range is below 9000 v.d.

An interesting feature of the work has been with malingerers. Records show that patients who are entirely deaf in one ear will give what we have termed a "shadow curve" when the telephone is at the deaf ear. This indicates that the sound when sufficiently loud will be conducted to the good ear. This is impossible when the noise apparatus is used in the good ear. Malingerers have shown that they will give no shadow curve no matter if the stimulating sound at the supposedly deaf ear be intense enough to be heard at a distance of several feet.

#### THE HIGHEST AUDIBLE TONE.

The upper limit of acuity is an unsolved problem. Regardless of the fact that practically all text books in Otology, Physiology, Psychology and Physics set rather definite limits, the wide variation in their statements leads us to feel that certain vital factors in making such determinations have been overlooked. For example, Bezold's Text Book in Otology and Howell's Physiology place the upper limit at 41,000 vibrations. Seashore's Psychology of Musical Talent says that a youth may hear thirty or forty thousand vibrations or perhaps even higher tones. Duff's Text Book in Physics gives the frequency of the highest audible tone as 20,000.



While otological practice may not necessarily demand the actual determination of the highest audible tone any more than it demands the lowest; differential diagnosis certainly makes it necessary to ascertain the relative acuity for tones in the upper portion of the tonal range.

Instruments available for such measurements are of four types: The Galton whistle, Koenig cylinders, the monochord and the telephone with some form of high frequency oscillator. The Galton whistle as modified by Edelmann is in such common use that no description here is necessary. It should, however, be remarked that the records with the whistles, to avoid error, should be in terms of vibrations. These are secured from the charts which accompany the whistles from the factory and which are calibrated for each whistle. It is insufficient to record the length of the pipe alone. The width of the mouth is also a determinant. Both vary in different instruments. Three whistles have been available for this study. Comparative results are shown below.

The Koenig cylinders are less widely known and a short description may be necessary. The cylinders, or bars, as they are often called, come in sets of 22 and are calibrated in the musical scale according to French notation from 8192 v.s. to 65,536 v.s. The tones arise from the longitudinal vibrations set up as they are struck with a metal hammer. Two sets have been available for this study.

Schultze's monochord, as modified by Struycken, consists of a steel wire maintained at constant tension between two uprights fixed on a rigid bar. Between these uprights a movable bridge passes over a fixed scale indicating the frequency. The tones may be excited by bowing. High tones are secured from the longitudinal vibrations set up by rubbing the wire with a friction sponge.

These are illustrated in Plate VI.

As a basis for comparison, determinations of the upper limit of acuity for a clinically normal adult observer were made. These are shown below. It is sufficient to say that in no examination we have made have these results been exceeded more than 2000 vibrations.

| Whistle No.      | UPPER LIMIT. | Calibrated to |
|------------------|--------------|---------------|
|                  | Upper Limit  |               |
| 378              | 49000        | 50000         |
| 1029             | 21000        | 29000         |
| 1813             | 23000        | 25000         |
| Koenig Cylinders |              |               |
| No. 1            | 49152        | 65536         |
| No. 2            | 43960        | 65536         |
| Monochord        | A.C.19000    | 25000         |
|                  | B.C.20000    |               |

The great variation apparent in these results may possibly have a very simple explanation. The Koenig cylinders are marked distinctly, according to the French custom, in terms of single vibrations. The whistles are simply in terms of vibrations which may be either single or double vibrations. If the calibration for whistle No. 378 be in terms of single vibrations also, the range in these observations will then be from 19000 to 24500 double vibrations, a discrepancy which may easily be attributed to the differences in intensity of the tones emitted.

All the evidence obtainable from the audiometer tests seems to indicate that tone gaps may occur in any portion of the range. The prominence given in clinical examinations to the determination of the upper tone limit indicates that defects in this region are of important diagnostic value. With the instruments just described, it is not possible to produce tones of continually changing pitch except with the Galton whistle, which would necessitate a source of continuous air pressure. The greatest difficulty, that of securing relative measures of intensity, would still remain unsolved. Again we have turned to the field of electricity for the solution of our problem.

#### VACUUM TUBE AUDIOMETRY.

It has been stated that the fourth method for securing tones of high pitch is by means of a telephone or some other form of tone generator in a circuit with an oscillating vacuum tube. Research in this field is of comparatively recent origin. Birnbaum in Germany, determined by this method the upper limit was 25000 v.d. In America, the great impetus given to the study and perfection of wireless telephony during the war has made it possible to secure standardized vacuum tubes. I have personally been in touch with five experimenters in the laboratories of the middle west who are using vacuum tube oscillators in making determinations as to the energy necessary to produce a minimum audible tone. So far as I have been able to discover, only one, Mr. C. E. Lane of the University of Iowa, has made any attempt at a determination of the energy required to produce audible sounds in the region of the upper limit.

It is not my intention to enter into the theory of vacuum tubes and their operation, but rather to show how far we have progressed in the application of this method toward measurements in the tonal range.

With the co-operation of the Department of Physics in the University of Iowa and under the immediate supervision of Dr. C. W. Hewlett, we have attempted to construct a workable vacuum tube audiometer. No attempt to get the apparatus in a practical form has so far been made. To accomplish our purpose two fundamental problems must be solved. First, a tone of continually changing pitch must be available. Second, accurate control of the relative value of intensity must be provided.

A diagram of the electrical connections is shown in Plate VII.

A brief study into the theory of vacuum tube oscillators shows that the frequency of the oscillations depends upon the inductance and capacity of the circuit. Variation in either of these factors will result in a corresponding change in frequency. In the system with which we worked, the inductance ( $L$  and  $L^1$ , Plate VII) formed a part of two circuits and since the capacity ( $C$ ) was in but one, it was decided that the latter should be our variable. A capacity with 120 steps producing tones from 2000 v.d. to the upper limit was constructed. Resistances for controlling the intensity similar to those used in the pitch range audiometer were provided. After trial, it was found that such an arrangement would answer very well, except that any tone gap lying between these steps would be missed. Moreover, the change in capacities resulted in a disturbing noise in the telephone receiver. A variable condenser in which these errors were eliminated had to be secured. Since none could be purchased, a condenser meeting the requirements was constructed as follows:

Semi-circular plates of metal, hermetically sealed and insulated, were mounted on a rotating shaft. As the plates are turned on this shaft, they dip into a vessel filled with mercury, the capacity being determined by the depth to which they enter the mercury. A pointer attached to the shaft passes over a scale to be calibrated in vibrations per second. This gives a continually changing capacity which results in a tone of continuously changing pitch in the telephone. We have at hand the necessary requirements for extending our research to the upper limit.

Our apparatus is not complete nor permanent. No measurements have been attempted. The practical benefit of such procedure is problematical. However, the procedure with the pitch range audiometer leads us to feel that many problems concerning the upper portion of the hearing range can be solved only by some such methods.

## THE DIFFERENTIATION OF EARLY MENINGITIS AND MASTOIDITIS.\*

WILLIAM J. MELLINGER, Santa Barbara, California.

Meningitis is a frequent complication of mastoiditis, but the presence of both meningitis and mastoiditis in the same individual, each having a different etiological factor, is very unusual. In an extensive search of the literature I have failed to find an instance of this kind.

The symptomatology of acute mastoiditis is so well known as not to merit detailed discussion here. It includes diminished hearing on the affected side, swelling and tenderness over the mastoid, pain about the affected area which may radiate, and frequently insomnia. In some cases the symptoms are very vague and present nothing except a dull, deep-seated pain.

The early symptoms of meningitis likewise need merely be mentioned. They are persistent headache, nausea and vomiting, bilateral deafness, drowsiness, and periods of restlessness.

The symptoms common to both conditions may be only headache, temperature and disturbance of hearing.

In the differential diagnosis of the two conditions, the symptomatology is of less importance than the physical examination, the Roentgen ray and the laboratory findings. In acute mastoid disease there is practically always local evidence of the disturbance, which may include redness and oedema of the soft tissues over the mastoid, narrowing of the canal near the drum, redness and bulging of the drum, unless it has been ruptured or been incised. The Roentgen picture may be negative early in the disease, but later will show cloudiness which may be due merely to acute inflammatory changes in the lining membrane of the air cells. This may go on to pus formation and bone destruction, when the picture will show a more intense cloudiness. The laboratory findings will demonstrate a polymorphonuclear leucocytosis, the count varying with the virulence of the infecting organism and the resistance of the host. The blood culture is negative unless a sinus thrombosis or a septicemia is present. The discharge from the ear will usually demonstrate the invading organism, also bone debris if bone destruction is present. In smears of the discharge stained lightly with hemotoxylin,

\*Read before the Fiftieth Annual Meeting of the Medical Society of the State of California, Coronado, May, 1921.

the bone debris appears as small, irregular, dark particles which can only be confused with precipitate from the stain. To avoid this, the stain should be filtered each time before using.

In meningitis resulting from mastoiditis or other focal infection, the primary condition is usually recognized. Careful search should be made for the same. In uncomplicated meningitis, the Roentgenogram is of no help. The physical findings may include rigidity of the neck, Kernig's sign, unequal pupils and strabismus, photophobia, hyperesthesia and unequal reflexes. The laboratory findings may demonstrate the presence of a leucocytosis, the cell count depending again upon the causative organism, the virulence of the infection and the resistance of the host. The spinal fluid gives the most accurate information and may be the only positive finding. In it an increased cell count and the causative organism may be demonstrated. If the organism is not found in smears, it may grow on culture media or may be found by animal inoculation.

My clinical example is that of a white school-boy, 15 years of age. He was first seen October 21, 1920. The family history was negative. The personal history gave the usual diseases of childhood, also typhoid fever at ten; scarlet fever at 12, at which time he was very ill for 45 days; and influenza three times, each attack being very mild. He had a severe cold and sore throat two weeks before, and with it a persistent cough. The onset was accompanied by sore throat, earache and severe frontal headache. The earache had been so severe that it prevented sleep. The mouth temperature was 103° F. At the time of the examination, which was three days after the onset, there was marked tenderness, redness and oedema over the right mastoid, and the ear was displaced forward. The external auditory canal was filled with a thick purulent fluid. There was a central perforation in the drum, it having ruptured spontaneously two hours before. The canal near the drum was narrowed as compared with the left side. There was no evidence of furunculosis. The left ear was entirely negative. The tuning fork lateralized to the right. Both tonsils were reddened and appeared to be slightly swollen. The surface was covered with a follicular exudate. The pillars were deeply injected, especially on the right side. Back of the palate a large adenoid mass could be seen, also a great deal of purulent mucus. He was taken to the hospital October 22, and he walked to his room. The urine was normal. Smears and cultures from the ear discharge demonstrated a pure culture of a diptheroid bacillus. October 23, a complete physical examination was made with negative findings. Under ether anesthesia both tonsils and

adenoids were removed and the opening in the drum was enlarged. The cultures from the tonsils and adenoids produced a pure culture of a diphtheroid bacillus. On October 26, the third day after the operation, the temperature was 98.6° F., pulse 74 and respiration 18. Erythrocyte count was 4,040,000; leucocyte, 10,000, with 18% small lymphocytes and 69% polynuclears; hemoglobin was 63%. On October 27, there was some pain in the ear and the drainage was free. He was somewhat drowsy and the face was flushed. On October 28, the fifth day after the operation, he was brighter and said he felt good. There was no pain in the ear, discharge was much less, the oedema and redness were gone and there was no tenderness. Temperature was 104°, pulse 108 and respiration 24. The urine was negative. The leucocyte count was 11,400, with 67% polynuclears. The next day he complained of pain in the lumbar region and vomited at noon after taking broth, also several times during the afternoon without reference to taking of food, the vomitus being a clear fluid. A physical examination revealed negative findings. Blood culture was negative. Temperature was 100.6° F., pulse 80, respiration 24. October 30, he was sleeping most of the time. He complained of pain in the back and severe headache. He was also nauseated and vomited some. The discharge from the ear had ceased. October 31, the temperature was 98.4° F., it having dropped 6.4° in the course of eight hours. Eight hours later it was 104.4°. The drum was healed and almost normal in appearance. The physical examination, urine analysis and blood cultures were negative. A Roentgenogram of the mastoid revealed no cloudiness. The Widal was positive, but he had had typhoid fever five years previous. The examination of the blood for malaria was negative. The leucocyte count was 13,800, with 75% polynuclears. On November 2, ten days after the tonsillectomy and four days after the beginning of the nausea and vomiting, he developed definite signs of meningeal irritation. He was very lethargic and at times restless. He complained of severe pain in the back of the neck and at the base of the brain. There was twitching of the arms during sleep. Both pupils were slightly dilated, the right more than the left. Reaction to light was very sluggish. The eye grounds presented nothing suggestive. There was some photophobia. The tongue deviated distinctly to the left. The summary of the neurological findings by Dr. N. H. Brush was as follows:

"Semi-stupor with restlessness; hyperesthesia of the whole body; photophobia; unequal reflexes and positive Brudinski's and Kernig's signs are strongly suggestive of a cerebro-spinal meningitis."



A lumbar puncture was then done. The fluid escaped under increased pressure and was perfectly clear. The cell count was 98. Smears from a centrifuges specimen revealed pneumococci. The next day an exploratory mastoidectomy was done with negative findings throughout. Cultures from the cells produced no organisms. He rapidly grew worse, sank into coma and died November 5, the thirteenth day after the tonsillo-adenectomy, the seventh day after the onset of nausea and vomiting, or the third day after the beginning of meningeal irritation.

The autopsy findings by our pathologist, Dr. Leonard Rothschild, were as follows:

"The brain was covered with a thick, purulent exudate, filling all the sulci from the cortex to the base. The pus and cerebral fluid both revealed large numbers of a gram-positive lancet-shaped diplococci, morphologically pneumococci. The blood sinuses were free from thrombosis and the ears on either side were clear. The lungs were expanded, and, scattered through the lobes were small, diffuse, punctate and conglomerated areas of hemorrhagic exudate. These were sub-pleural and resembled closely the picture of an influenzal hemorrhagic pneumonia. On incision these areas were found to be filled with a bloody, frothy fluid, in which pneumococci were present in large numbers. These were definitely not abscesses or true consolidations. The microscope showed them to contain a large cellular exudate in which mononuclear cells predominated. Pneumococci were found in the lung tissue. The anatomic diagnosis was a lobular pneumonia acting as a focus, resulting in septicemia and lepto-meningitis."

An analysis of this report reveals a mastoiditis following a tonsillitis, the causative organism being a diphtheroid bacillus. After tonsillo-adenectomy, the middle ear condition healed completely, as demonstrated by physical examination, Roentgenograms and an exploratory mastoidectomy, at which time cultures from the mastoid cells were sterile. But during convalescence from the tonsillectomy, the patient developed a lobular pneumonia which terminated fatally in a pneumococcal meningitis. During the course of the illness it was difficult to be certain that the meningitis was not a sequel of the mastoiditis, but the various data, as given above, demonstrated that there was no connection between the two. This was also borne out at autopsy.

During life the pneumonia was not recognized and this made the explanation of the meningitis more difficult. If Roentgenograms



of the chest had been made in addition to the physical examination, it is possible that the condition would have been discovered.

The first spinal puncture revealed clear fluid with a cell count of 98 and pneumococci found in the smears and on cultures. Within 24 hours the fluid was very turbid and had a high cell count which demonstrates how rapidly the condition progresses.

The removal of the patient's tonsils and adenoids during the acute stage of the middle ear suppuration and the bearing of this procedure upon the subsequent pneumonia remain to be considered. For years it has been generally recognized that disease of the tonsils and adenoids is the most important factor in middle ear suppuration. The removal of the tonsils and adenoids after the acute infection of the middle ear has subsided, has been practiced routinely, either to cure a chronic suppuration or to prevent future acute attacks.

Leland<sup>1</sup> in 1913, advised adenoidectomy during the acute state of middle ear infection, in order to obviate lancing the drum. Glogau<sup>2</sup> goes farther and advises the removal of both tonsils and adenoids during the acute illness to prevent the more serious operation of mastoidectomy. He maintains that the earlier this is done the better, and practices it routinely. This procedure I also followed, and the middle ear infection subsided promptly. That the patient developed pneumonia may be attributed to this procedure, but why might it not just as likely follow a mastoidectomy, which is frequently done? I have removed the tonsils and adenoids in the presence of acute middle-ear suppuration with mastoid symptoms in twelve other instances, and in each the condition subsided rapidly.

#### CONCLUSIONS.

1—That the patient had middle-ear suppuration with mastoiditis caused by a diphtheroid bacillus.

2—That the development of meningitis was not related etiologically to the mastoiditis.

3—That, early in meningitis, the spinal fluid may be clear, yet contain the organism.

4—That the advisability of early tonsillo-adenectomy in the presence of middle-ear suppuration to obviate a mastoidectomy is logical.

#### REFERENCES.

- (1) GEO. A. LELAND: *THE LARYNGOSCOPE*, 1921, Vol. XXXI, p. 106.
- (2) OTTO GLOGAU: *THE LARYNGOSCOPE*, 1920, Vol. XXX, p. 83.

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## THE TONSIL QUESTION UP TO DATE.

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The subject has been made so very vast by the discovery of physicians that the removal of diseased tonsils will cure or ameliorate many physical disorders. Furthermore, because of the vast number of tonsils removed oftentimes without fear or favor, by men and women whose preparation for laryngological work has been very limited in so-called post-graduate schools, we wonder if many suffer amputation unnecessarily. Our country is literally flooded with a large number of men who are illy prepared for this work. Laryngology cannot be learned in all its details in from four to six or eight weeks, no matter how intensive the courses may be, for that time is not sufficient to learn the fundamentals which every one should know before one attempts operative work at all. Nothing has been said as to the associated subjects of otology and ophthalmology usually practiced in connection with laryngology.

What the tonsil question will be ten years hence no one can say, because the subject is in a state of flux.

Into the minutiae of the subject we will not attempt to go, our text books suffice for that information, except where a review is necessary to fix salient points in the discussion.

*Embryology.* According to His, the palatal arches appear so that the sinus tonsillaris appears at the third month of foetal life. The plica tonsillaris appears also by a flattening of the tonsillar tubercle. According to Hammar, at this time also appears the intratonsillar fold which divides the fossa into a superior and inferior one. At the end of the fourth month, the crypts appear from the sprouts which spring from the mucosa, as is beautifully shown in the explanation of this subject in Barnes' work on the Tonsil. Within the buds, the lymphoid tissue begins to develop late in embryonal life (according to Grundwald, at seven to eight months). The works of Stöhr, Grundwald, Hammar, Kollmann, His, Wright and Barnes, should be consulted to bring this subject up to date.

*Anatomy.* The tonsils may be described as masses of lymphoid tissue placed in the sinus tonsillaris, and loosely attached to the surrounding structures.

The pillars are the palato-glossus and the palato-pharyngeus muscles, the former forming the anterior pillar and the latter the posterior pillar with their coverings of mucous membranes.

The plica triangularis: Its base is in the lateral wall just above the tongue and its apex is attached to the inner border of the posterior pillar above. Its support of the tonsil has been likened to that of a sling.

The capsule is merely a portion of the intrapharyngeal fascia or aponeurosis having its upper attachment at the base of the skull and extending downward into the region of the esophagus.

The anterior surface of the tonsil is covered with epithelium while all the rest not covered with the epithelium is covered with the capsule.

It is usually agreed that we have two types of tonsil: The pharyngeal, as Stuckey puts it, and the pedunculated. Both may be enormously hypertrophied and yet on casual examination of the pharynx may show nothing as to their true character. Moreover, both may be the seat of fibrous infiltration and become atrophied.

The blood supply as usually given is thus: Arteries—The external carotid artery sends in the pharyngeal branch and the tonsillar to the lower half. The facial ascending palatine branch to the upper half. The lingual dorsalis to the anterior pillar and the upper segment, and the descending branch of the internal maxillary. The veins form a plexus in the walls of the sinus, the larger ones empty into the pharyngeal plexus with veins from the epiglottis and the base of the tongue. The smaller ones empty into the lingual veins. We are compelled to revamp our ideas thus expressed for Poynter, professor of anatomy in the University of Nebraska, has not been able to trace all this supply and finds that we have one less vessel entering the tonsil than we have supposed, which may be comforting information to us in the cases of severe hemorrhage that we some times encounter on making tonsillectomy. I would also call attention to the work of Beck, who demonstrated the circulation of the tonsil by injecting lead solutions into the tonsillar circulation and then making X-ray plates thereof.

A lymphatic system leading into the tonsil is yet to be proven. It is not difficult, however, to demonstrate the lymphatics leaving the tonsil, especially in a severe case of Vincent's angina, such as I recently saw in which the whole glandular system stood well out in the neck so as to readily demonstrate all the groups of the cervical nodes as they lie on the sterno-cleido-mastoid muscle.

Because of the information which Professor Poynter gave us at the recent meeting of the American Academy of Ophthalmology and Oto-Laryngology concerning the circulation of the tonsil, I wrote him to ascertain what information he might have concerning the

nerve supply of the tonsil and its relation to reflexes that the tonsil might cause. Among other things he wrote: "Branches from the pharyngeal plexus and also probably direct from the trunk of the glossopharyngeal pierce the constrictor muscle and form a plexus on the outside of the tonsil, the tonsillar plexus from which branches run through the body of the organ being distributed to its substance and mucous membrane. I have done just enough work to be convinced that among these rami there are secretory fibres which probably come in from the superior ganglion, both by way of the pharyngeal plexus and accompanying the arteries, principally the palatine branch of the facial. Of course, the real difficulty in working out this problem is to find out what the components of the pharyngeal plexus are. No attempt has ever been made in any form higher than reptiles, so it is really very little use to work out the finer distribution of the different rami till we have some definite idea where they come from. From the evidence at hand we are quite sure that even the glossopharyngeal trunk is very complex and carries sympathetic fibres whose source is not yet certain." In other words, there is yet a vast field for work before us to determine all we can concerning the nerve supply of the tonsil and the reflexes possible because of its ramifications and connections with other nerves. But more of this under another head.

An abnormality occasionally encountered is the ingrowth of the styloid process. Some contend that it is new bone formation thus encountered in the tonsil and not the styloid process.

*Histology.* Briefly it is universally recognized that the tonsil is a mass of lymphoid tissue (lymphocyte) tissue supported by a framework of fibrous tissue, the capsule or trabeculae (Barnes). Carmody has pointed out that muscle fibres may be found in the trabeculae.

The crypts are usually branched and may contain pockets. These latter make the most trouble for their possessors, because they harbor indefinitely effete material which unable to escape must break down into pus and be absorbed into the general system. This may be hastened by the erosion of the epithelium which their pressure makes. The epithelium lining the crypts is of a flat corneous type as is that of the surface of the tonsil. The capsule is fibrous tissue with occasionally aberrant muscle fibres interspersed. When the tonsil degenerates it is because of the development of fibrous tissue therein which by its contraction really chokes out the lymphoid tissue, hence atrophy takes place and we have ultimately the small, hard fibrous tonsil.

*Physiology.* If anybody has yet developed anything which tends to show that the tonsil has a function, let him stand forth and declare the same. It has none unless before the age of six. Yet this is no warrant for their unnecessary decapitation or enucleation. I am aware of the experiments of Lenart, who injected coloring matter into the nasal mucous membrane of dogs and recovered it in the tonsils of both sides. Wright is of the opinion that tonsils removed in infancy are liable to recur just like a lobster's claw will regenerate when removed. He also states that they lose their function and become pathological structure when the child reaches the age of four or six.

Kenyon and Kradwell have reached the following conclusions: (1) The tonsil serves as an absolutely necessary factor in providing a channel for the action of the palatoglossus muscle. (2) The function of the tonsil with reference to the palatopharyngeus is to afford support and protection to its great normality of action. In other words, the tonsil has a function which is of a physico-mechanical nature, according to these writers.

*Its Diseases.* These may be defined as acute and chronic, and new growths (or tumors). Acute—Acute tonsillitis, Follicular, Septic, Suppurative, Quinsy, Vincent's Angina, Actinomycosis, Diphtheria, Chancer. Chronic: Chronic tonsillitis, Suppurative intra-tonsillar, Cystic, Calcareous Degeneration, Hyperkeratosis, Tuberculosis, Syphilis. Neoplasms: Benign—Papilloma, Fibroma, Lipoma, Angioma, Fibro enchondroma. Malignant: Carcinoma, Sarcoma.

Owing to the complexity of our subject and to approach as quickly as possible the more important phases of our subject, we will pass this section of the paper with the simple mention of the diseases, trusting to the discussion to bring out any new points thereon.

*Pathology and Bacteriology.* The difference between the normal tonsil and the diseased tonsil is one of the amount of fibrous tissue present in the tonsillar substance. The difference between the ordinary hypertrophic tonsil and the small fibrous tonsil is in the way in which a large amount of fibrous tissue has destroyed much of the lymphoid tissue ordinarily present. So marked may be the contraction of this tissue that surgeons have made error in diagnosis and have taken the small, hard tonsil to be papilloma of the tonsil. Wright has pointed out that this fibrous tissue may further degenerate into granular or hyaloid tissue, or rather matter, around which may cluster collections of epithelioid and atypical giant cells. The buried tonsil and the ordinary pedunculated tonsil may not differ at all in size.

From tonsils have been recovered the following bacterial flora: Streptococcus, hemolyticus viridans and mucosus. Pneumococcus, epidemicus. Staphylococcus, pyogenes aureus and albus, also citreus. Spirillum of Vincent-Plaut. Fusiform bacillus of Miller. Friedlander bacillus. Klebs Loeffler bacillus. Influenza. Tubercle. Ray fungus of Actinomycosis.

*Etiology.* According to Wright, the primitive type of jaw is not associated with Tonsils and adenoid masses. The narrow jaw of civilized man is. Children have tonsils and adenoid masses because parents transmit the narrow jaw to them. The narrow jaw is an evolutionary trait. In addition to this trait recurrent coryzas of children tend by recurrent inflammations to cause the tonsillar tissue to hypertrophy by direct continuity of tissue.

*Diagnosis.* Simple inspection will oftentimes be sufficient to establish a diagnosis as to the actual condition present. However, it may be necessary to differentiate between syphilis, Vincent's angina, tuberculosis and diphtheria. Then recourse must be had to the laboratory, which is as essential in the office of the laryngologist as to the man in internal medicine or surgery. Every suspicious tonsil should be cultured in addition to the smear examination.

The tonsilloscope of French seems to offer us a valuable means of determining the presence or absence of retention cysts harboring bacteria at the base of the tongue, especially, in addition to pathogenic processes in the tonsillar substance itself.

It is wise not to neglect to introduce the finger in making up the diagnosis as to the condition present in the affected tonsils. Of course, recourse will be had to the mirror also.

*Relation to Immediate and Distant Parts of the Body.* (1) The tonsil may cause direct pressure upon the Eustachian tube. By continuity and contiguity of tissue, inflammation may spread to surrounding tissues. We all recognize the tonsil as the possible cause of ear trouble via the Eustachian tube. Whether due to the spreading inflammation or to the outpouring of detritus is immaterial.

(2) By involvement of the lymphatic circulation from the tonsil. "The lymphatics from the tonsil number three to five, and pierce the buccopharyngeal fascia and constrictor pharyngeus superior and pass between the stylohyoideus and internal jugular vein to the uppermost of the deep cervical glands. They end in a gland which lies at the side of the posterior belly of the digastricus on the internal jugular vein. Occasionally one or two additional vessels run to small glands on the lateral side of the sternocleidomastoideus. These glands receive efferent vessels from the internal maxillary



lymphatics and from the submaxillary lymphatic glands, the lymphatic vessels from the cranial cavity, the deep muscles of the upper part of the neck, the posterior part of the tongue, the middle portion of the pharynx, the upper part of the larynx and the upper part of the thyroid body. The ultimate endings of this system are the right lymphatic duct and the thoracic duct. The former empties into the subclavian vein or the internal jugular vein at the juncture. The thoracic duct empties into the subclavian vein (left)." Gray.

We are able oftentimes, in a very severe case of Vincent's angina, to beautifully trace out these efferent vessels way down the neck, *i.e.*, the lymphatic drainage of the tonsil. This swelling of the lymphatic circulation may further involve the recurrent laryngeal nerve, the motor nerve that supplies all the intrinsic muscles of the larynx save the cricothyroid. From such an involvement may come dyspnoea, hoarseness, paralysis and even change of the voice.

Moreover, Gerber injected Chinese ink into the tonsils of dogs and was able to trace the dye into the deep cervical glands and thence directly into the apical pleura, and parenchyma of the lungs.

*Reflexes Due to Diseased Tonsils.* Very little has been written upon this phase of the subject. One of the best articles is that of the lamented Frank Todd, read before the Section of Otology and Laryngology of the 1910 Meeting of the American Medical Association.

We are all familiar with the ear disturbances in a case of quinsy or severe tonsillitis, the pain presented upon deglutition only and quite severe. It is no doubt a reflex, though some may explain it otherwise.

Many reflexes may result from tonsillar hypertrophy and inflammation as pain in the nose, teeth, gums, hard palate, antrum of Highmore, sphenoid, ethmoid, orbit, pharynx, larynx, trachea and the ear, like tinnitus.

Ordinarily the anatomy of the nerve supply of the tonsil in the text books is dismissed with a statement like this taken from Deaver's Surgical Anatomy: "Nerve Supply—From the Glossopharyngeal Nerve and Branches of Meckel's Ganglion." Like statement is made in Gray's Anatomy. But if one will take the time and patience to trace out the origin and distribution of the glossopharyngeal and fifth nerves the study will very readily explain the origin of numerous obscure symptoms merely to be reflexes from the tonsil, via these nerves and their synapses with other important ones. Poynter, in the latter part of his personal letter, states: "From the



evidence at hand we are quite sure that even the glossopharyngeal nerve trunk is very complex and carries sympathetic fibres whose source is not yet certain. This furnishes material for any amount of speculation without giving us anything definite."

Further the sensory root of the sphenopalatine ganglion (Meckel's) is distributed to the mucous membrane of the nose, soft palate, tonsil, uvula, roof of the mouth, upper lips and gums, and the upper part of the pharynx. It is connected by the Vidian nerve to the facial. The sphenopalatine ganglion is the largest of the sympathetic ganglia associated with the branches of the trigeminal. The middle and posterior palatine branches join the tonsillar branches of the glossopharyngeal to form the plexus circulus tonsillaris (around the tonsil). The sphenopalatine ganglion is connected with the tympanic branch of the glossopharyngeal nerve.

The branches of the glossopharyngeal are the tympanic, carotid, pharyngeal, muscular, tonsillar and lingual.

"The tympanic branch arises from the petrous ganglion and passes to the inner wall of the tympanum. It ramifies on the promontory forming the tympanic plexus, which supplies branches to the round window and to the Eustachian tube, and communicates with the carotid plexus and with the great and small superficial petrosal nerves." (Deaver.)

The tonsillar branches supply the palatine tonsils, forming around them a plexus from which filaments are distributed to the soft palate and fauces where they communicate with the palatine nerves.

Moreover, the glossopharyngeal communicates with the vagus and the latter sends branches to the pharynx, larynx, to the hypoglossal nerve and the sympathetic and the first and second cervicals. Besides the vagus communicates with the spinal accessory.

Thus, when one follows out the ramifications of the glossopharyngeal nerve and Meckel's ganglion, it is not hard to see those various neuralgias noted by observers, may be caused by the tonsil by pressure and otherwise, how even functional facial paralysis and facial neuralgias may result, how various laryngeal disturbances are produced, resulting in laryngeal cough and hoarseness, spasm of the glottis, difficult deglutition, with disturbances of heart action and dyspepsia.

The reverse may also be true. Tonsillar trouble may be caused by reflexes originating elsewhere along the course of these nerves.

The trifacial and glossopharyngeal nerves are exceedingly sensitive.

*Relation of the Diseased Tonsil to Focal and General Infection.*  
In the last twelve years the operation of tonsillectomy has replaced the older operation of tonsillotomy. Within that time enormous numbers of tonsils have been removed for various causes and conditions. Many conscientious workers have put on record the results of their work and a vast literature has been accumulated on the subject of tonsillectomy. We are now able to do what we have not been able to do before: to trace out the possible connection between diseased tonsils and certain conditions which are found to be cured or markedly ameliorated by complete tonsil extirpation. Of course, in a discussion of this kind the simultaneous removal of the adenoid is considered a part of the operation of tonsillectomy, especially in children, if an adenoid is present.

Even yet, sufficient literature has not appeared upon this important subject to warrant us in drawing any hard and fast conclusions as to the relationship that chronically diseased tonsils bear to general systemic infection. Nevertheless, we are justified in drawing valuable conclusions from this accumulated literature, as well as from our own individual experiences.

While this vast literature has been accumulating during the past twelve and fourteen years, comparatively few articles have been published dealing with this relationship, and as noted before, but very, very few on the reflexes that diseased tonsils may cause. Hence any further contributions dealing with this phase of the subject will be very welcome indeed to both internist and laryngologist alike.

Taking the LARYNGOSCOPE's most excellent and unusual Index Medicus and Digest of Oto-Laryngology as the basis of our search, we find the following to be true:

For the year 1909 there were published 93 articles upon the tonsil. Eleven of these deal with infections caused by diseased tonsils, and most all with the relationship to tuberculosis.

For the year 1910, 134 articles appeared, of which 17 deal with the infection relationship.

For the year 1911, 180 articles were published, of which 26 deal with this phase of the subject.

For the year 1912, 140 articles, of which 22 are upon infection relationship. In this year appeared Mackenzie's article on the "Masacre of the Tonsil."

For the year 1913, 157 articles were published, of which but 17 deal with this relationship.

For the year 1914, 128 articles, and again the small number of 14 are upon this subject.

For the year 1915, 140 articles, and only 14 on this subject.

For the year 1916, 98 articles, and the largest proportion to that date, for 25 appeared to trace out the relationship of the diseased tonsil to focal and distant infection.

For the year 1917, there appeared 109 articles, and 27 deal with the question in hand.

For the year 1918, 92 articles were published, with 20 on infection.

For the year 1919, 100 articles, with 15 on this relationship.

For the year 1920, according to the Quarterly Cumulative Index of the American Medical Association's Journal, 68 articles appeared to October 1st, of which only four deal with this relationship.

Thus, to date there have appeared 1439 articles on the tonsil, the great bulk of which relate to operative procedures and their post-operative effects or immediate consequences, like hemorrhage, etc. Out of this vast literature, but 212 deal with the relationship of the diseased tonsil to toxic infection and reflex effects, or about 15 per cent of the whole. We wish the proportion were greater.

Nevertheless, we may express surprise that the tonsils have been removed for the cure of such a very large number of conditions, and we wonder, if in their zeal, reporters may not have stretched the truth a little, in tracing out mythical relationships of diseased tonsils to infection, which others seem to be unable to so trace.

Yet, anyone with a large experience with tonsil work, has seen some of the conditions enumerated below, benefited by complete extirpation.

According to the literature, tonsils have been responsible for the following conditions which I have endeavored to group and classify thus:

Genito-Urinary group—Acute Nephritis, Pyelocystitis, Albuminuria, Paraneuritis, Acetonuria following quinsy, Orchitis, Hematuria, Hematuria with some albuminuria.

Arthritic group—Septic infection of the joints.

Rheumatic group—Neuralgias, Lumbago, Perineuritis, Myositis, Tenosynovitis, Sternomyelitis, Indurative headache.

Cardiovascular group—Acute myocarditis, Endocarditis, Phlebitis, Leukemia, acute, Anemia.

Eye group—Iritis, Choroiditis, focal, Optic neuritis, Retinitis, hemorrhagic, Paralysis of accommodation.

Ear group—Otitis media, non-suppurative, Otitis media, suppurative, Otosclerosis, Mastoiditis, Gardenigo's syndrome, Disturbances of equilibrium, Earache.

Pulmonary group—Tuberculosis, Asthma, Secondary pleurisy, Bronchopneumonia.

Gastro-intestinal group—Gastric fever, Ulcer of the stomach, Appendicitis, Recurrent vomiting, Jaundice, Pyorrhea alveolaris.

Glandular group—Splenic infarction secondary to phlegmonous peri tonsillitis, Cervical adenitis, tubercular with abscess, Parotitis, Goiter.

Infectious disease group—Influenza, Scarlet fever, Diphtheria, Measles, Poliomyelitis.

Nervous disease group—Chorea, Hemiplegia, Meningitis, Vertigo, Recurrent encephalitis and meningitis.

Septic group—Septicemia, Severe sepsis, General infection.

Miscellaneous group—Skin lesions, many, Bad breath, Syphilis, Temperature increase, Sinus disease in children, Febriculae with no other symptoms, Bad dental arches, Voice disturbances, Aproxia.

This is surely a formidable array of diseases chargeable to the chronically diseased tonsil. Can it be possible that tonsils are unnecessarily removed? A great many believe that it is a case of "get the money." I should hate to believe it so.

However, the other side is to be considered for the following sequellae are reported as the result of tonsil removal: Basedow's disease, Pains in the stomach, Speech disturbances, Acute myocarditis, Endocarditis, Suppurative joint trouble, Lung abscess, Hyperplasia of the peritonsillar gland, Injury to the singing voice, Acute articular rheumatism, Otitis media, Pneumonia, Foreign bodies in lung, teeth, Facial paralysis (Stucky), Mastoiditis, Death. Some from general septicemia.

Some of these sequellae would have occurred if the tonsils had not been removed, no doubt.

At this point I wish to direct particular attention to lung abscess following tonsillectomy. It really is becoming too common. Bossum reported a case in 1913, probably the first one to be reported. Then Scudder and Manges in 1916. Clendenning blames the motor driven ether and suction apparatus for the trouble.

According to Cutler and Hunt, in the July (1920) number of the *Archive of Surgery*, one patient out of 30 to 50 operated upon develops lung complications, and one in every 150 to 185 dies from such complication. They believe that pneumonia, pleurisy, bronchitis, empyema, lung abscess or fatal pulmonary embolism may occur and that pre-existing tuberculosis may show exacerbation. This means all kinds of cases operated upon in general.

According to Hedblom, the symptoms may not show for a period of months or years, and no immediate symptoms may be present. Cutler and Hunt believe that the cause lies in embolism from the operative field. Whipple is of the opinion that inhalation anesthesia on top of a pre-existing lung lesion may in some cases be the factor.

Burgen has reviewed the literature since Manges' report in 1916, and believes that blood-borne infections are quite common. Incidentally he advises more care in preparation for operations, and that the patient must remain in bed for several days following the operation. He advises local anesthesia for older children and adults, and in young children, great care in general anesthesia. Every care and precaution must be taken against inspiration of foreign material into the lungs.

Lung abscess occurs in one out of every 781 cases.

I have had one case of lung abscess following tonsillectomy.

I have had one case wherein after tonsillectomy, a severe infection of the right knee joint developed, and for which I wished that I had had for use an autogenous vaccine prepared from the excised tonsils. It may be good practice to make a culture from every pair of tonsils removed so that an autogenous vaccine may be quickly prepared when needed.

It has been my misfortune to have lost a case from diathesis hemorrhagica after tonsil removal. Had we taken the coagulation time prior to operation, this distressing accident need never to have occurred. Death after tonsil operation have been reported by Gabbett, Lillie and Lyons, Barnhill, Ard, Stucky, Schuchardt, Thompson, Stewart, Goldsmith, Damanos, Heeman, Burger and others. Many are the reports of serious secondary hemorrhage after tonsillectomy. The last report of the New York Post-Graduate Medical School on tonsil work shows that in the last three years, four deaths have occurred following tonsil extirpation. The report adds "that is not many." But one death thus is an awful experience for a surgeon to endure. It is a complication to be feared and dreaded, always.

The paper of Layman before the 1917 meeting of the parent Society is of great value in this connection, for he communicated with internists as well as laryngologists to ascertain the "Results Obtained by Tonsillectomy in the Treatment of Systemic Disease." I have taken the liberty of retabulating Layman's figures so as to be able at a glance to take in the actual situation as to prognosis.

Layman's Collection of Figures Reported to Him.

*Retabulation of Case Reports—Systemic Diseases.*

|   | Real Cures | Improvement | Negative |
|---|------------|-------------|----------|
| Arthritis .....                                   | 262        | 184         | 14       |
| Cardiovascular .....                              | 3          | 25          | 4        |
| Renal .....                                       | 21         | 12          | 4        |
| Rheumatic group,<br>Neuralgias, lumbago, etc..... | 230        | .....       | 3        |
| Chorea .....                                      | 33         | 17          | .....    |
| Cervical adenitis.....                            | 57         | 51          | 12       |
|   | 566        | 289         | 36       |

Total 891.

Following tonsillectomy what cases developed the following:

Acute exacerbation of systemic disease:

|   |    |
|---|----|
| Arthritic .....                         | 10 |
| Goiter .....                            | 1  |
| Post-operative low grade infection..... | 9  |
| Nasal sinus trouble.....                | 49 |

Total.....69

In other words, as the result of the investigations conducted in the papers referred to above, we find that there is an undoubted connection between infections and diseased tonsils, of which the latter are the causes. Further, the evidence seems to show that tonsillectomy has a distinct therapeutic value in curing or alleviating many of the diseases enumerated.

I cannot go as far as some who advocate the removal of tonsils and adenoid masses as a prophylactic measure, though of the latter stand I have been covertly accused, because once in an institution over which I happen to be ophthalmologist and laryngologist, I removed the tonsils and adenoids of forty-eight children out of a population of 150.

Therefore, we will continue to remove tonsil and adenoid masses for the following reasons at least:

- (1) To remove obstructions to the breathway.
- (2) To remove focal infection, as well as distant infection.
- (3) Preparatory to the correction of bad dental arches.
- (4) To cure aprosexia.
- (5) To relieve deafness.
- (6) To relieve certain nervous affections, like chorea.
- (7) To remove new growths.
- (8) For recurrent tonsillitis and quinsy.

But we would not be true to ourselves and to our patients if we regard the tonsil as the sole portal of infection. We must be physicians first and laryngologists last. Therefore, before removing tonsils it becomes our bounden duty to search for possible existing foci elsewhere, for the following organs may be the cause of infection or reflexes and unless corrected, tonsillectomy will be disappointing: The teeth. The accessory sinuses of the head. The gall bladder. The gastrointestinal tract; the appendix. The bronchial glands. The lymph nodes. The lungs for tuberculosis. The eyes.

For we must not operate in acute infections, luetic processes, advanced tuberculosis, advanced cardiovascular changes, diabetes mellitus. Where the blood shows delayed coagulation time, high blood pressure, status lymphaticus, in the presence of fever in children, for the latter may usher in measles, scarlet fever or diphtheria.

In fact, a complete examination of the patient should precede tonsillectomy. If the examination shows no other focus of infection, then we may confidently expect that tonsillectomy will cure the trouble the tonsils are causing in at least 60 per cent of the cases; that benefit will accrue in 30 per cent, and that no result will be expected in 10 per cent.

The patient may have reflex disturbances from other organs which have no connection with infection whatever, for as ophthalmologists also, I wish to call attention to quite an array that one meets with due to eye-strain. The correction of the refractive error causes such to disappear. Many such cases have been advised to have tonsils removed and had the advice been heeded the disappointment that the patient would have suffered would have been acute and not very creditable to the tonsil operator.

*Treatment.* The treatment is resolved into the prophylactic, medicinal and surgical.

Little can be said as to the former except that oral hygiene is of prime importance, that the mouth may guard the tonsil against the invasion of noxious bacteria and other deleterious substances. Inasmuch as it has been shown that recurrent coryzas predispose to tonsillar trouble, the nose should be kept in as normal a condition as possible. General hygiene must be so taught and practiced that the future will see a race not possessed of the conditions that predispose to tonsillar inflammation, acute or chronic.

Medicinal treatment must necessarily be reserved for acute conditions as a rule excepting the acute conditions, like quinsy, and among the chronic conditions, such diseases as syphilis, tuberculosis and the like.



Of course the medicinal treatment will be suited to the condition present.

Let us take acute follicular tonsillitis first: When the patient presents himself or herself, I know of nothing better for the initial local application than the ammoniated tincture of guiac, a very old-fashioned remedy, but very valuable. As all present more or less fever, a calomel purge is indicated. I like to give one-half grain of calomel with three grains of quinine every three hours until the bowels thoroughly move or until six doses are taken, followed by a saline purge if necessary. A simple gargle composed of a teaspoonful of baking soda in a teacup of water as hot as the back of the hand will stand is extremely soothing. The whole teacup is to be used. It is to be repeated every hour, made fresh, each time.

If the throat be septic, antistreptococic serum injected subcutaneously is indicated. At any rate an autogenous vaccine should be prepared from the contents of one of the crypts, and used as an adjunct.

Vincent's Angina: The ulcerated surface is to be first curetted until clean. Then a strong solution of nitrate of silver (30%) is to be rubbed vigorously in the raw surface. Arsphenamine has been recommended, but I have never seen it indicated as yet. Of course, the alkaline gargle indicated above is a *sine qua non*. Keeping the mouth clean will hasten a cure.

Diphtheria really belongs to the general practitioner and such cases are always referred to him.

In syphilis local measures avail little as a rule. What the patient is in need of is arsphenamine intravenously, together with good old-fashioned mercury and iodide of potassium as needed.

*Surgical Treatment.* Tumors know no treatment except complete eradication, either by excision if benign and by the actual cautery if malignant, after the manner of New.

Quinsy knows of no cure but the knife. At the first incision no pus may show. It will be necessary to repeat the incision later until the pus is evacuated.

Cyst of the tonsil may be evacuated if discovered. However, the discovery is usually made after extirpation only. Any tonsil because of focal and distant infection should be removed by tonsillec-tomy. It is no use to fool with tonsillotomy at all. This includes fulguration and circumcision.

Murphy, Witherbee, Craig, Hussey and Strum of New York, in the Journal of the American Medical Association for January 21, 1921, advocate the use of the Roentgen ray applied externally to

the tonsillar region to cause atrophy of the tonsil and cite some forty cases in justification of the discovery of the treatment. This certainly ought to be tried out, for it may prove to be a very valuable method, especially in cases of hemophilia and status lymphaticus needing tonsillectomy.

As to the particular form of tonsillectomy: I have none, for I find it best to be able to use any method when needed. We have not yet reached the ideal tonsil operation. We are awaiting its appearance. I must confess that whenever I can I do like to use the snare method of Beck and the tonsillectotome method of Sluder.

For every tonsillectomy the patient should be in the hospital the day before, because observations must be made as to the condition of the patient's urine, the temperature and the coagulation time of the blood. The bowels should be thoroughly opened.

*The lingual tonsil.* The same diseases affect it as the faucial tonsils. Yankauer, at the last meeting of the parent society, showed specimens removed by the galvano cautery snare, using ordinary steel wire instead of the very expensive platinum wire. Here the tonsilloscope of French is valuable in the diagnosis of retention crypts in these infratonsillar structures.

*The Adenoid.* The adenoid is a mass of lymphoid tissue. It is supposed to be regressive after the age of puberty. But no doubt it is the common experience of us all to find large adenoid masses even in grown up folks. In fact, the adenoid is liable to grow as we grow up.

The adenoid is subjected to the same inflammations which affect the nose itself. The same coryzae cause acute inflammations and as a result the adenoid hypertrophies, causing the train of symptoms so familiar to us all.

The adenoid knows no medicinal cure. Total extirpation is the rule. Care should be taken to introduce the finger after removal to be sure that no tags remain behind, and if any are present, to curet them with the finger nail. Here the tactus eruditus of the ophthalmologist comes in very handy.

May I say that the tonsil and adenoid operation should be as bloodless as possible, especially in children. Too often these little folks leave our hospitals looking like little corpses from excessive loss of blood at the time of the operation. Some operations eliminating dissection ought to be employed and then all bleeding points should be clamped and tied, just as does the general surgeon on making an operation.

**SYPHILIS AS A FACTOR IN MASTOIDITIS, PRODUCING  
SYMPTOMS OF SINUS THROMBOSIS.  
REPORT OF A CASE.\***

DR. WILLIAM G. SHEMELEY, JR., Philadelphia.

That syphilis is capable of producing symptoms simulating those found in any other disease is well known to the medical profession. The literature is rich in reports of peculiarly puzzling cases which eventually were proved to be of luetic origin. The diagnosis of the luetic feature in these cases was made possible by comparatively recent developments.

The following case is reported to show how readily one may make an incomplete diagnosis in any case unless all of the clinical data available is obtained, the more so, if latent syphilis happens to be present.

Case Record No. 3593. J. I., age 9 years; male.

Family History: Father and mother living and well. Paternal grandfather died at the age of 60 years with an undiagnosed liver condition. Father's twin brother is living and well. Three sisters living. One sister suffers from severe headache, always worse from 4 P. M. to midnight. One sister has a peculiar dermatitis of the fingers. The father of the patient also has the same character of skin condition. Paternal grandmother died at the age of 72 years from pneumonia. Maternal grandparents are both living and well; both are past 65 years of age and both happen to be very deaf. The maternal grandfather suffers from a recurring mild cystitis. The patient's mother has three brothers and two sisters living and well.

Patient's History: He suffered from the usual diseases of childhood; however, these diseases took on a more or less atypical character and recovery was delayed. In 1917, patient was operated for a mastoiditis of the left side. This was atypical in that the amount of bone destruction appeared to be out of proportion to the temperature, which never exceeded  $99\frac{3}{8}$  F. The patient made an uneventful recovery with the exception that at times he developed an unexplainable rise of temperature of transient duration, which would promptly subside to normal. These temperature rises were attributed to the presence of enlarged and diseased tonsils and adenoids. The tonsils and adenoids were therefore removed, and at

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\*Read before Philadelphia Laryngological Society, Jan. 4, 1921.

the same time a circumcision was performed in May, 1917, following which the child enjoyed good health until November, 1919, when he suffered from an acute serous otitis media of the right ear.

The mother stated that in June, 1919, the patient had been knocked down by an automobile and his nose broken. Since that time he had not seemed so well as before and has suffered from severe colds, which he had been free of following the adenoid and tonsil operation in 1917.

Examination of the nose reveals an S-formed deviation of the septum with a pronounced spine along the suture line on the right side. The anterior ends of both inferior turbinates are swollen and hypertrophied; the posterior end of the right inferior turbinate is hyperplastic.

A rather imperfect view of the posterior pharyngeal wall is obtainable through the nares, but sufficient to show the presence of adenoids.

The otoscopic appearance of the right ear follows: Tympanic membrane intact; slightly dull in that the cone of light is less brilliant and diffused. The lower half of tympanic membrane presents a yellowish tint marked off from the upper half by a distinct Niveau line. Upon Politzer inflation bubbles appeared in the fluid followed by a lowering of the Niveau line. December 20, 1919, the patient had entirely recovered from the attack of acute exudative middle ear catarrh of the right side.

January 7, 1920, patient had a recurrence of his ear condition. Tuning Fork Tests reveal:

| R.E.  |           |   | L.E. |
|-------|-----------|---|------|
| ?     | Weber     |   | 1.3" |
| 1.15" | Schwabach |   | n.   |
| —15"  | Rinne     | + | 20"  |

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sl. sh.? Air n.

When the fork is placed in right mastoid, patient refers sound to the left ear. The test was made only with the greatest difficulty.

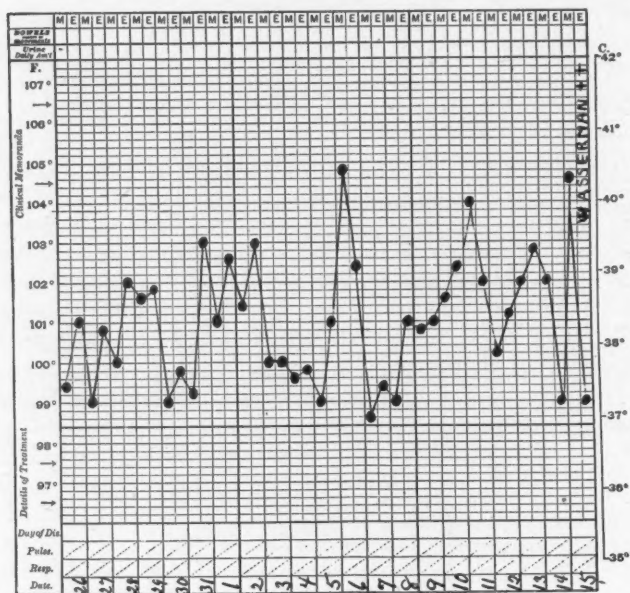
January 14, 1920:

| R.E.  |           |   | L.E. |
|-------|-----------|---|------|
|       | Weber     |   |      |
| 1.20" | Schwabach |   | n.   |
| —25"  | Rinne     | + | 22"  |

---

sh. 20" Air n.

Otoscopic Examination: Right ear—Details are not discernible because of the dullness and opacity of the membrane. There is slight bulging of the membrane posteriorly, which is yellowish in color. After shrinking mucous membrane of nasal cavity and the region of the Eustachian tube orifice, repeated daily Politzer inflation was done, with the result that the middle ear condition again subsided. Shortly afterwards the patient was again operated for adenoids. On the 24th of January, 1920, the patient developed an acute purulent otitis media of the right ear. In spite of a prompt myringotomy and free drainage, the middle ear condition became



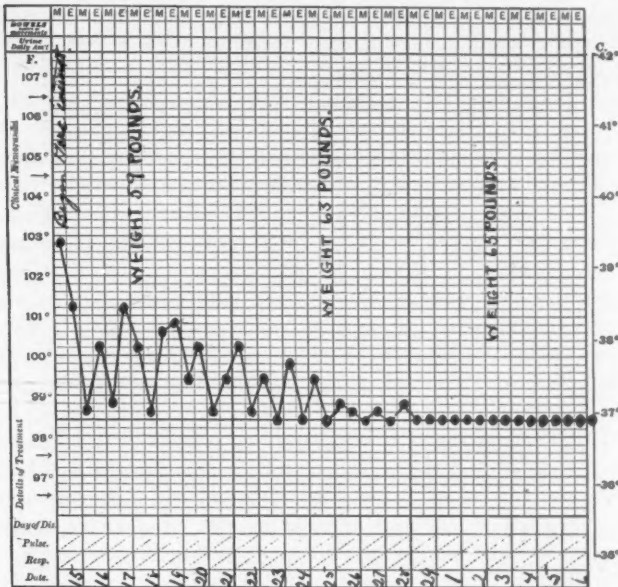
worse. Tenderness developed over the right mastoid while the temperature reached 103 F.

Blood Examination by Dr. E. Q. St. John, of the Philadelphia Clinical Laboratory, showed:—

Hemoglobin 67 per cent. Actual quantity 9.18 per cent. Erythrocytes 3,320,00. Leucocytes 8,500. Polynuclear Neutrophiles 86 per cent. Small lymphocytes 7 per cent. Large lymphocytes 1 per cent. Transitional 6 per cent. Polynuclear Neutrophiles: 1 seg-

ment 39 per cent; 2 segments connected; 2 segments 55.5 per cent; 4 segments; 5 or more segments.

X-ray examination of the right mastoid and head by Dr. W. C. Barker of Philadelphia, showed (1) the mastoid on the right side gives a slight degree of cloudiness with a coalescing of some of the cell walls, especially noticeable in one spot posterior to the auditory canal, and extending downward toward the tip. There is no shadow along the bony wall of the lateral sinus that would suggest a thrombus. (2) The skull wall throughout gives a mottled appearance due to an irregular thickness of the skull bones. This con-



dition occurs in Paget's Disease, syphilis, chloroma and also in cases of metastatic carcinoma. Carcinoma occurs usually late in life and may be excluded in children. Paget's Disease occurs in adult life and likewise may be excluded. Syphilis may occur at any age and chloroma occurs in childhood. Chloroma is associated with pronounced anemia and blood changes similar to those met with in leukemia which were absent in this patient. Besides the formation of the lens dense areas in this case approximate more nearly in appearance those found in lues rather than those seen in chloroma.

February 2, 1920. The patient was operated for acute mastoiditis of the right side. The simple operation was done. The bone was found to be very soft. The temperature fell from 103 F. at the time of the operation to 100 F. the next morning. Two days later the morning temperature was 99 F. That night at 10 P. M., patient had a chill and temperature rose to 104 $\frac{4}{5}$ . Patient had no complaints to make. Wound was re-dressed and found to be in good condition. Two days later the patient had another chill; temperature rose to 101 F. Then continued to rise until two days later when it reached 104 F., then fell to 100 $\frac{1}{5}$  on the morning of the 12th of February. The next day patient had another chill; temperature rose to 102 $\frac{4}{5}$  F., then fell to 99. Another chill on the 14th of February found the temperature reaching 103 $\frac{3}{5}$  F. It again fell to 99 F. on the 15th of February.

At this point the Wassermann report was received from a specimen taken two days previous, and showed a ++ reaction. Daily inunctions of 48 grains mercurial ointment were begun on the 15th of February, at which time the patient's temperature was 102 $\frac{4}{5}$  F.

The improvement in the patient was prompt and progressive. Temperature reached 98 $\frac{4}{5}$  F. on the 25th of February, and remained normal thereafter. Patient improved in general health. His parents claim that he is in better health than ever before. Present weight 98 pounds. The father's Wassermann showed a ++ reaction, as did also that of the two sisters, but the mother's proved negative. Tests made on November 30, 1920, showed both father and son weakly +. Mother still negative.

This case was reported for three reasons, namely: (a) The value of a good X-ray report is demonstrated, without which in this case the underlying factor of syphilis might not have been discovered. (b) The striking similarity between this case and the clinical course of a case following operation and developing thrombosis of the lateral sinus. (c) To demonstrate the prompt response of luetic conditions to the institution of prompt and vigorous anti-luetic treatment.

1831 Chestnut Street.



## HEMANGIOMA OF THE LARYNX.\* \*\*

DR. THEODORE H. SWEETSER, Minneapolis, Minn.

Although telangiectatic growths are not infrequently seen in the larynx, true hemangioma of the larynx is a fairly rare tumor. The literature has been reviewed in recent years by Phillips and Ruh,<sup>1</sup> by Mayer,<sup>2</sup> and by New and Clark.<sup>3</sup> Fifty-five cases of angioma, including eight of lymphangioma, were included in the analytical table published by the last named authors in December, 1919. I have found no reports of later date, though my search of the literature has disclosed a number of cases not included in any of the above reviews.\*\*\*

The case herewith reported is unique in some respects, and suggests rather important conclusions when studied together with the heretofore reported cases. My case is especially noteworthy because of the age of the patient, the type and situation of the growth, and the peculiar kind of hemorrhage.

*History of the Case:* Baby boy, L. L., was born prematurely at about eight months on April 20, 1920, and died on June 21, at the age of 62 days. The father and mother are living. This was the only child. He appeared to be normal for some days. At the age of nine days he had a series of attacks of cyanosis with poor respiration, tachycardia, and cardiac arrhythmia. Administration of oxygen accomplished relief. A feeding of three-quarters of an ounce of breast milk was regurgitated, deeply colored with red; this I presume to have been blood. The baby was unable to swallow the next two feedings given at three-hour intervals. From that time improvement was continuous, and he left the hospital six days later, gaining in weight and nursing from the breast regularly. There had been no fever.

About five days before death the family noticed that the baby had some difficulty in breathing. At first the family physician considered asthma, but later sent the patient to the Minneapolis Gen-

\*Read before the Minnesota Academy of Ophthalmology and Oto-Laryngology, Oct. 8, 1920, and before the Minnesota Pathological Society, Oct. 19, 1920.

\*\*From the Department of Pathology and Public Health, University of Minnesota.

\*\*\*Since presentation of my paper, an article on "Angeliomata of the Larynx," by Irwin Moore of London has appeared in *The Journal of Laryngology and Otology* for January and February, 1921. To his review of 73 cases should be added the case reported by Fallas (11), as well as the one herein reported.

eral Hospital as a case of possible laryngeal diphtheria. On admission at 10:15 p. m., June 21, 1920, physical examination showed slight general cyanosis, dyspnea, and marked retraction of the supraclavicular spaces on inspiration. The temperature was 100° F. by rectum. A nose and throat culture was taken, but no *B. diphtheriae* found.

Intubation was attempted; the tube passed easily into the pharynx but could not be introduced into the larynx. As the posterior pharyngeal wall seemed to bulge slightly, a few small incisions were made in the mucosa there, but no pus was obtained. Dyspnea grew rapidly worse, and the patient died at 10:40 of the same evening. I was called upon to perform a post-mortem the following morning.

*Autopsy Findings:* The body is that of a well developed male infant, 55 c.m. long and of about 3000 grams weight. There is no edema, cyanosis or jaundice. There are no angiomas to be seen in the skin. The serous cavities are free from excess fluid and adhesions. The stomach contains some clotted blood (presumably from the incisions in the pharyngeal wall). The liver weighs 140 grams; its cut surface is light yellowish brown, and microscopic section stained with sudan iii shows a diffuse extreme fatty change in the liver cells. There is no other noteworthy pathology in the abdomen.

The heart is normal, except for three very minute bright red nodules at the free margin of the mitral valve leaflets. The ductus arteriosus barely admits a small probe. The aorta is normal. The lungs are partially collapsed; they show neither hemorrhages nor pneumonia. The bronchi and trachea appear normal on gross examination. The thymus weighs 12 grams and shows no lesion. The tongue, tonsils, soft palate and esophagus are normal. There is some clotted blood in the tissue posterior to the oral pharynx, and in the mucous membrane there are several fresh very short incisions. No purulent exudate is found.

On opening the larynx and trachea longitudinally through the posterior wall, one sees a diffuse, flattened, grayish purple bulging of the mucous membrane within the circle of the cricoid cartilage. This bulging has its upper border at a level two to three m.m. below the vocal cords and extends downward therefrom for a distance of 5 m.m. to the lower border of the cricoid cartilage. It occupies the entire circumference of the larynx with the exception of a narrow zone at the posterior commissure. The greatest thickness is in each lateral wall. The epithelium is not ulcerated, but shows a little loss of sheen in two or three places. Cross-section

of the larynx through the cricoid cartilage (see Fig. 1) shows a flattened mass lying between the cartilage and the lining epithelium. The cut surface of the mass is mottled dark red and gray and has a slightly granular appearance. A zone directly adjoining the cartilage at each side is dark red without the mottling of gray. The thickness from epithelium to cartilage on the right side is 3 m.m., and on the left side 2 m.m. The whole space within the cricoid cartilage at a level 5 m.m. below the vocal cords measures 5 m.m. transversely and 7 m.m. anteroposteriorly. The lumen of the larynx near that level appears to be entirely closed, and a little lower it forms a triangular chink measuring 0.5 m.m. transversely by 1.5 anteroposteriorly.

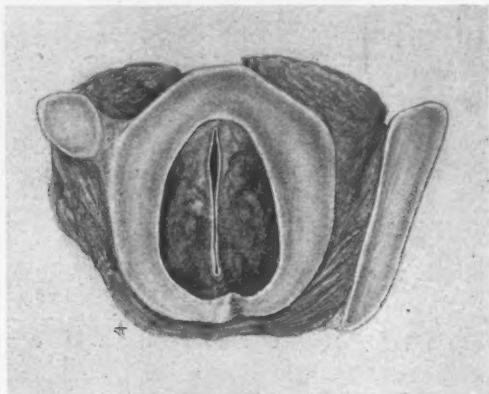


Fig. 1. Drawing of cross section of larynx through tumor. Ring of cricoid cartilage shown; also parts of thyroid cartilage and laryngeal muscles. Closure of lumen of larynx is shown to be due to compression by tumor. Darkest zone just inside cartilage is the intramural hemorrhage.

*Microscopic Examination:* The epithelium in some places is normal; but in other places it is thin. There the superficial layers are absent, and the cells of the remaining layers are shrunken, with pyknotic nuclei and deeply eosin-staining cytoplasm. Directly beneath the epithelium there is a narrow zone of dense fibrous tissue which appears normal except for a little dilatation of the blood vessels. More deeply there is a large abnormal area involving all the circumference excepting the posterior commissure and composed of closely-set large and small new blood channels with prominent endothelium. In some portions these channels are cavernous, in others they are quite small. The delicate stroma between the channels is a very young type of reticular connective tissue (see Figs.

2, 3 and 4). Between the blood spaces are scattered numerous mucous glands. These are in an active state; that is, the cells are filled with light-staining mucus and the nuclei are flattened peripherally (Fig. 4). The tumor laterally is separated from the cartilage by a zone of quite fresh but certainly antemortem hemorrhage. In places the hemorrhage extends into the tumor, but for the most part is in the meshes of a fibrous connective tissue of normal appearance adjoining the cartilage.

The condition found in this case corresponds in every respect to a true hemangioma. The large new formed blood vessels with very thin walls of prominent endothelium are quite characteristic, as is the delicate stroma of primitive reticulum. Such structure be-

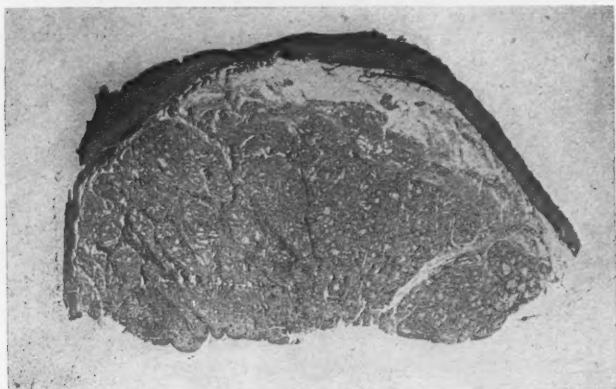


Fig. 2. Half of cross section of larynx through cricoid cartilage. Microphotograph, low power (X 15). Margin of cartilage is dark stained semicircle above; mucous membrane shows below. The larger blood spaces of the tumor can be clearly seen.

longs to a true neoplasm rather than to a telangiectasis. Active growth is indicated in this case by the absence of encapsulation.

The structure of the tumor in my case is remarkably similar to that in the case described by Phillips and Ruh.

Hemangiomas are congenital. They increase in size, as a rule, for some time after birth, and then usually tend to become encapsulated and to remain stationary<sup>4</sup>. In my case the tumor must have been growing since birth and the lumen of the larynx must have been markedly reduced by the time the parents called their physician for the child's dyspnea. At the time of the attempted intubation the tumor had almost entirely filled the lower part of

the larynx. It seems probable that the hemorrhage into the tissue within the unexpandible ring of the cricoid cartilage was sufficient to close completely the already markedly constricted air passage.

*To Summarize the Case:* An infant, aged eight weeks, became markedly dyspneic, the dyspnea increasing progressively until within five days an intubation was attempted as a last resort. Death followed quite promptly from suffocation. An autopsy, a hemangioma was found almost filling the ring of the cricoid cartilage. In addition, an intramural hemorrhage at the same place completed the closure of the air passage.

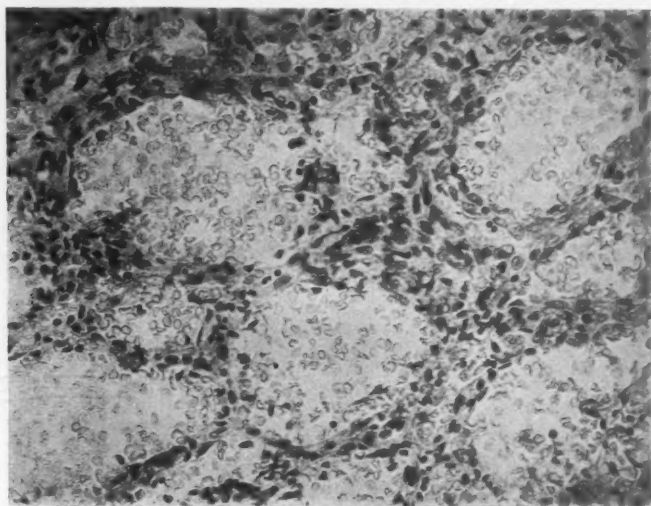


Fig. 3. Section of tumor. Microphotograph, high power. Shows some of the larger blood channels and a small amount of reticular tissue.

*Discussion:* In a search of the literature I have found reports of 25 hemangiomas in people more than twenty years of age, one in a girl 19 years old, one in a boy 13 years old, one in a boy 6 years old and three in infants less than one year old. Mine is the fourth in a child less than a year old, and the patient is, to the best of my knowledge, the youngest mentioned thus far.

Of the 38 cases of hemangioma, my own included, from which I have a record of sex, 66 per cent have been in males.

A study of the situations and characteristics of hemangiomas of the larynx leads to a rather striking conclusion not heretofore noted:

it appears to me that the laryngeal hemangiomas seen in adults are very different from those found in infants and children.

Among the 48 cases, including my own, in which the situation of the tumor is given, 40 have their attachment upon or above the true vocal cords, and are not attached to the laryngeal wall below the cords. At least 38 of these 40 patients were more than twenty years old when first examined, and the age of the other two is unknown. Among the same 40 patients, all the tumors described macroscopically, with one possible exception, were sharply projecting, raspberry-like or smoothly rounded growth. Some were peduncu-

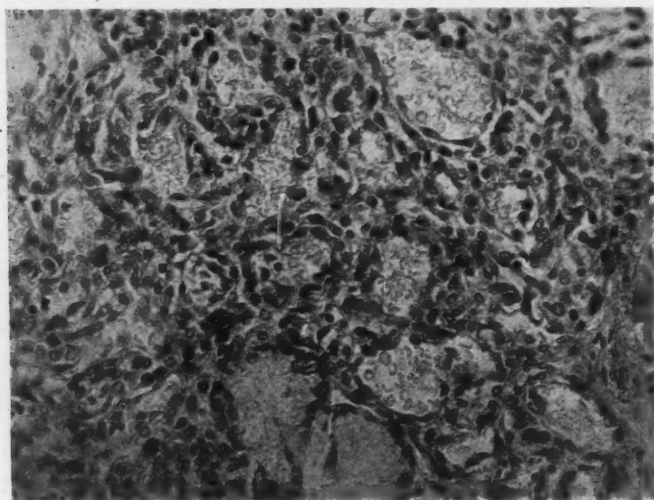


Fig. 4. Section of tumor. Microphotograph, high power. Shows smaller blood channels with more prominent endothelium, and some primitive reticular connective tissue. Below is seen part of one of the mucous glands.

lated, and some had broader bases, but all were sharply demarcated, projecting growths. Hoarseness was a predominant symptom; dyspnea was relatively unimportant. The above series I conceive to represent a definite type of tumor found in adults and not to be confused with a different type found in infants.

In 8 of the 48 cases in which the situation of the tumor was noted, the attachment has been entirely below the true vocal cords. Two of the patients were adults (one seen by Martuscelli and Porfidia<sup>5</sup> and one by McKinney<sup>6</sup>), but in them the tumor was pedunculated



and in gross appearance otherwise resembled the type seen in adults and described above. The age of a third patient<sup>7</sup> is not given. In the case of one boy 6 years old with a subglottic angioma,<sup>8</sup> the description of the tumor is not clear. One boy 13 years old<sup>9</sup> showed a subglottic cavernous angioma so large as practically to fill the larynx and cause severe dyspnea. The other three cases were of infants 9 months,<sup>1</sup> 9 months<sup>2</sup> and 2 months old (my case), respectively. All these showed subglottic tumors, large in comparison to the size of the larynx, sessile in attachment, flattened, and somewhat diffuse. Dyspnea was the prominent symptom.

It is worthy of note that true laryngeal hemangiomas are exceedingly rare in infancy, and that they are all subglottic and sessile, and cause serious interference with respiration. On the other hand, true laryngeal angiomas are less rare in adult life, are found almost always upon or above the vocal cords, and are distinctly rounded, projecting, and sometimes pedunculated tumors; they cause relatively little dyspnea, but rather hoarseness of voice.

The following two cases have been excluded from the above classification. Levbarg's<sup>10</sup> case of angioma in an infant ten weeks old is not included because the tumor seems to have been primary in the mouth and pharynx and to have involved the larynx only secondarily by direct extension. In a recent letter from Dr. Levbarg, he said: "I do not think that the growth originated primarily in the larynx. Upon direct laryngoscopy the tumor was slightly elevated, but spread out profusely, involving first the region above the vocal cords and then subsequently spreading below the vocal cords." A case reported by Fallas of Brussels,<sup>11</sup> would also hardly be placed in either of the types described, as the involvement included the arytenoids, false cords, left true vocal cord and subglottic region as well as the skin of the neck and possibly the lining of the pharynx.

The danger of hemorrhage has been repeatedly emphasized in the literature. Desvernine,<sup>12</sup> in 1888, reported a case giving occasional spontaneous bleeding from the throat, and at one time a severe hemoptysis. Wolfenden<sup>13</sup> said that laryngeal angiomas occasionally lead to recurrent hemorrhage. Ferreri,<sup>14</sup> in 1888, told of a case of angioma on the left vocal cord, which he crushed with a forceps. Alarming hemorrhage occurred at night and was controlled with difficulty by applications of ferric chlorid. Tracheotomy was performed, but another violent hemorrhage took place at that time and, although it was controlled, the patient died from pneumonia within 48 hours. Edmund Meyer,<sup>15</sup> in 1904, strongly advised thy-



rotomy as the operation of choice in a child, because "even if intra-laryngeal operation were successful in removing the tumor, the hemorrhage would prove fatal." Ryerson<sup>10</sup> tells of Shurly's case in which tracheotomy was performed to relieve dyspnea. "The growth entirely encircled the lower laryngeal and upper tracheal region. In opening the trachea, the growth was incised, which gave rise to uncontrollable hemorrhage, which resulted in the death of the patient." Phillips and Ruh<sup>1</sup> state that serious hemorrhage may occur. Mayer<sup>2</sup> emphasizes the danger of death from hemorrhage if a part or all of the tumor is removed intra-laryngeally. New and Clark<sup>3</sup> have also emphasized the danger from hemorrhage. Thus, it is seen that there is a real danger of hemorrhage either into the lumen of the larynx or into a laryngotomy or tracheotomy wound.

My case emphasizes the danger of hemorrhage of a different sort. Here there is a hemorrhage into the tissue within the ring of the cricoid cartilage. Such a complication must be very rare, as my search of the literature has not revealed any similar case. The danger in such a condition is not from the loss of blood, but from the interference with the passage of air through the larynx, resulting in suffocation. The danger from this intramural hemorrhage is, of course, much greater in the sessile subglottic type of angioma found in infants than in the type found in adults.

*Treatment:* When possible, radium application is, without doubt, the treatment of choice for angioma of the larynx, as for angioma of other parts of the body. Ryerson<sup>10</sup> first used it with success, and New and Clark<sup>3</sup> have more recently used it with good results. Surgical removal of the tumor either intra-laryngeally or through laryngotomy is a distinctly dangerous operation. Laryngotomy seems to have been less dangerous than intra-laryngeal removal of the tumor.

However, an operation for the relief of dyspnea may be necessary in infants as an emergency measure. Intubation has been advocated by some, tracheotomy by others. Intubation was successfully performed by Levbarg<sup>10</sup> and by New and Clark. On the other hand, the latter authors state that "intubation in such cases is not safe, because the trauma associated with such procedure is likely to produce severe hemorrhage." In the case herewith reported, it seems that an already severe constriction of the larynx was increased somewhat by hemorrhage into the tissue at the time of the attempted intubation, and the death probably somewhat hastened thereby. Mayer has, on various occasions, strongly advised against any intra-laryngeal operation. That tracheotomy, on the other hand, is not

free from danger is shown by the cases of Shurly<sup>16</sup> and Phillips and Ruh,<sup>1</sup> in which the tumors extended into the upper part of the trachea (in the latter case, the tumor extended to the third tracheal ring). In Shurly's case, death followed incision of the tumor during tracheotomy. When tracheotomy must be performed it would seem that it should be as low as possible and with adequate preparation made in advance for the prompt control of a possible profuse hemorrhage. In the case I am reporting, I do not see how a diagnosis of angioma could have been made before the autopsy. Intubation was the logical treatment. The only possible lesson that could be learned is that in obscure cases one should be prepared to do a low tracheotomy immediately, should intubation fail to relieve the dyspnea.

## SUMMARY.

1. Hemangioma of the larynx is rare, and especially rare in children.
2. Males are affected twice as frequently as females.
3. Two types should be recognized: (a) An adult type, distinctly rounded and projecting, often pedunculated, occurring almost always upon or above the vocal cords, and characterized clinically by hoarseness of voice with only occasional slight dyspnea. (b) An infantile type, sessile in attachment and usually rather flattened and diffuse, occurring always below the vocal cords and characterized clinically by serious interference with respiration.
4. Hemorrhage is the most serious complication; it may occur spontaneously, but is usually the result of operative interference. An intramural hemorrhage may occur, especially in the infantile type, and may cause sudden death by suffocation.
5. Radium treatment is indicated as the only safe method for the cure of the condition.
6. As an emergency measure for the relief of dyspnea, most authors state that tracheotomy is preferred rather than intubation, though both are dangerous. Tracheotomy should be as low as possible, and every preparation should be made for the checking of any profuse hemorrhage.

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## PHILADELPHIA LARYNGOLOGICAL ASSOCIATION.

A stated meeting of the Philadelphia Laryngological Society was held on Tuesday, January 4, 1921, at 8:15 P. M., Cadwaladar Hall, College of Physicians.—Clinical Night.

### "Case of Congenital Webbing of Vocal Cords." Dr. W. F. Moore.

I regret that I am unable to present this patient before the Society as he is a Pullman conductor and is on a trip to Chicago. This is true case of congenital webbing of the vocal cords. I was unable to obtain a history of traumatism, diphtheria or any other malady which may have any bearing upon this case. It is really marvelous what he can do with so small an amount of space in the larynx. I hope that I will have the opportunity to present him to the Society sometime.

### "Report of Some Interesting Mastoid Complications." Dr. W. L. Cariss.

I have two cases. Neither is unique but each has some interesting points I hope will serve to bring out some discussion. First—a young man of 22 years of age with history of having had influenza three months before having been seen. There was slight pain and temperature twenty-four hours before but no discharge. There never has been. There were no symptoms referable to the ear. Three months later he had tenderness over the posterior area of the left mastoid region but ear condition was perfectly normal; he had absolutely nothing but this point of tenderness. He was taken to the hospital for observation. He had a leucocyte count of 9000. He stayed in the hospital for two or three days and improved, leucocyte count dropping, and he was discharged perfectly well. Six months later he came back with considerable edema and swelling, seemed quite sick and had temperature of 101°, leucocytes above 13,000. The next day swelling disappeared over the mastoid area. Leucocyte count at that time was 16,000. He was operated on. He had a small abscess which had perforated through the cortex. I found a dense clot in the sinus. The middle ear was absolutely normal. The man made an uneventful recovery. He had no symptoms except just before he was operated on. The second case—a girl of eight years of age. Following measles she had an acute otitis media which was watched for some days. Finally the mastoid had to be opened, and the streptococci hemolytic was obtained. But the temperature kept around 103° and the sixth day patient became septic. The internist said not to operate. There was nothing in the lungs. The condition got worse and on the fifteenth day following the original mastoid operation I felt it advisable to do another operation. I thought she had a sinus thrombosis. I opened it and found extensive sinus thrombosis. Temperature still remained up and for some weeks afterwards. Before operation there was nothing to show that patient had a sinus thrombosis; she had a moderate leucocytosis. About a week after operation, patient had septic chills and showed evidence of sinus thrombosis. She had a streptococci hemolytic all the time. The temperature stayed up for over five weeks after her thrombosis operation and suddenly headed normal and never was above that. The third case was a young man admitted to the hospital for tonsillectomy. Five days after operation developed otitis media and a few days later mastoid symptoms. He was operated on and also had streptococci infection. Recovery was uneventful, but was delayed. The mastoid incision did not close very well. On the third day following, patient suddenly vomited without cause and was all right for a few days. Then a few days later he had another attack. Headaches be-

came very much more severe, vomited and showed symptoms of brain abscess. It seemed advisable to open it up. I found absolutely nothing in the mastoid area. The left side was perfectly normal but on the right side there was an abscess. Patient, however, became worse and died. Another case—complained of pain over the mastoid area for two or three days. There was no other symptom except the pain. Two years ago patient was in the St. Joseph's Hospital for a very similar attack, but he was not operated on at that time. I saw him this morning, he has some little edema of the mastoid, there is drooping of posterior wall, leucocyte count 10,600 and there is a little more edema this afternoon. I am convinced that this man has a mastoid condition yet there is absolutely nothing to indicate he has a mastoid. The middle ear is perfectly normal.

#### DISCUSSION.

DR. GEORGE M. COATES: We used to call these cases primary mastoiditis. In recent years we have all seen cases that come in this classification. Dr. Ersner and I saw several last year. They are difficult to diagnose when you have not your middle ear symptoms to go by. Dr. Cariss' first case had a sinus thrombosis also. I would like to know what attention he paid to the internal jugular vein, whether he excised, tied or left it alone. The best method of taking care of your internal jugular vein is to excise it or let it alone. The question has not been decided. Somebody said that just as good results were obtained where the jugular was ligated and not excised. Many cases of jugular sinus thrombosis get well without having been recognized. The lateral sinus, of course, must be cleared out. It would be interesting to know how Dr. Cariss treated those two from that standpoint.

DR. W. L. CARISS: In both those cases the jugular was excised. I feel that, particularly in the second case where the temperature remained up as the jugular was left and not cleared out and evidently was absorbed, the vein thrombosed in the neck.

DR. GEORGE M. COATES: Where the vein is thrombosed it is much better to excise. I would like to know in the cases where he did not have the thrombosis extending into the neck, whether he excised the jugular. My experience has been to excise the jugular.

DR. H. S. WIEDER: While I have had no experience with similar cases, the general history of this case interested me. I recall a case when Dr. Musser was living. We had a man who was running a typical septic temperature for one month from 105° to normal. He was studied from every standpoint but we did not have the Wassermann to go by at that time. Dr. Musser finally came to the conclusion that it was specific and after administering specific treatments, the temperature dropped and patient got well almost immediately.

DR. P. SAMUEL STOUT: In 1910 when we were just beginning to use 606 in this city, Dr. Frazier happened to be passing our clinic and said that if we had any chronic ears with suspected syphilis to send them to him. I selected eleven cases. The Wassermann was being done at that time. Ten had positive Wassermans. They only got in those days one dose of 606 and were considered cured. Hardly any of them came back, they were better. I saw them but did not apply any nose and throat treatment. One had been coming to the clinic for twenty years and now said he was cured. These typical cases should all have a Wassermann. There probably are ways of getting syphilis that we do not know of, even when the family history is perfectly good.

DR. GEORGE W. MACKENZIE: I had the privilege of seeing this case and watched it with him more or less. This temperature chart should not be confused with that of sinus thrombosis as in involvement of the sinus we get a more chopped temperature than that. Concerning the subject of syphilis, it may be well for a few of those who may not yet be familiar with Wilcox of San Francisco to follow a course laid out by him and by

Beck of Vienna, to study cases of syphilis in early and in late stages. They found that bone conduction was shortened in both sides out of proportion to the impairment of hearing in bone conduction. They claim it is almost an infallible sign of syphilis. Syphilis can come even after the appearance of the chancre. It is found by spinal fluid test, functional test, etc. It is well for those who had not been practicing it to know the bone conduction in all cases. Make functional hearing test in every case. When we find hearing and bone conduction diminished, when it should be lengthened, the first thing to suspect is syphilis. Syphilis in conjunction with the ear and the method of examination and making functional hearing tests for the presence of syphilis is very interesting.

Dr. R. F. RIDPATH: At the present time at St. Agnes Hospital, we have a case which I thought Dr. Shemely was giving the report on. This child had been sick for six weeks before they brought it here. When it arrived, the external canal was filled with a pussy discharge, no puffiness or swelling of the mastoid, tonsils quite large and inflamed and considerable adenoid tissue. The baby had been running a temperature typical to Dr. Shemely's case for some time. Dr. Robinson who came on with the baby had done a parasentesis and in that way saving the membrane, but the case went on to mastoid involvement. Three days before I operated, an X-ray was taken and it was found that the mastoid cells were entirely broken down. There seemed to be a certain number of symptoms, especially temperature, I could not account for. After the operation, a Wassermann was taken and also a spinal puncture and a 2-plus Wassermann reaction was found. We cannot always go by the parents. In spite of the daddy being a minister it did not prevent me from having a Wassermann taken. Do not hesitate to have Wassermann if you cannot account for any of the symptoms.

Dr. WM. G. SHEMELY: In closing. Syphilis was always a very interesting problem to me. However, we are rather led into that attitude because of the number of cases we have treated in the past and not attaining satisfactory results only to find ultimately that they are syphilitic. Recently the procedure has been adopted in practically every case. Tests are taken even in cases that are operated on. The findings may be some days late but we have the benefit of checking up. We find in a number of cases that in spite of almost a feeling of definite certainty of the patient being syphilitic, many of them congenital, very few have any straight history. A number of them improve under anti-leptic treatment. In spite of a negative Wassermann they are syphilitic. In May of this past year we operated on a young woman, a war widow. We did a septum operation. She had ethmoid trouble, turbinates and tonsils. She was not discharged but told to come back in about six months. She came back in November, complaining of obstruction of breathing. She felt all right until August, and now felt worse than she did before the operation. Examination of the nose showed a bilateral tumor. By separating the tissues we made an incision on both sides and got into some real nice, gummy tissue that we sent to the laboratory. We made hearing tests—shortened six seconds on the rights, nine seconds on the left. Positive Rinne. Laboratory report came back 4-plus. She was put on iodid potassium increasing doses. First thing she noticed that she felt much better. Absolutely no discomfort. She feels like working now, before she did not. She has absolute freedom of breathing.

Dr. W. F. Moore's patient came in and was presented.

**"Demonstration of Instruments for Eversion of Tonsils." Report of Cases. Dr. H. H. Lott.**

There are as many ways of removing the tonsils as there are people here tonight. The simple method is better for all concerned. There is a hook at the end of this instrument. To dissect put this on either side into the body of the tonsil and it is possible to evert the tonsils. No hemorrhage. Technic of the rest of the operation is probably as you all



do it if you use the snare method. The only advantage with this instrument is that there is nothing complicated about it and anyone can use it. Any tonsil can be everted with it. We did about 350 at the hospital in the last year or so and they have been tonsils from the size of a peanut in a child two years of age to large tonsils. There is nothing elaborate about it. It is a simple matter to evert the tonsil from the tonsillar fossa. It does the same thing as the Sluder except that with the Sluder instrument you evert the tonsil from the rear.

DR. P. SAMUEL STOUT: I have seen Dr. Lott use it many times. With him I suppose it is very easy but before anyone tries to use it they must get used to it. From the way he does it and the results he has obtained and the simplicity he has accomplished, it would pay anyone to drop in and see him use it. To try to use it without seeing it done I doubt whether you would be successful.

**"Case of Focal Infection." Dr. James A. Babbitt.**

It was my desire to make a preliminary of three important cases of focal infection, which apparently had remarkable results, but three adverse conditions prevented satisfactory, full reports at this time.

Patient number one had, as reported to me by a consultant oculist, a very strong man in this city, the following conditions: "In the right eye there is the most extensive hemorrhagic neuro-retinitis, with numerous thrombi in the larger veins and retinal changes far out into the periphery, together with some fine areas of disseminated choroiditis, associated with a very fine punctuate hyalitis. In the left eye, as you observe in your letter, the same condition is just beginning, although there are very few hemorrhages, but also in the periphery, in less marked degree, the changes to which I have referred." Most careful tests were made including a spinal Wassermann.

A complete exenteration of the ethmoid cells, relieving the seriously blocked nose with a marked deviation of the septum, has apparently absolutely relieved the symptoms. The adverse situation is that the patient has gone to Italy and I have only the report resulting five months after the operation.

Patient number two was a case of rapidly progressing involvement of the eye, the vision reduced two-thirds. After a removal of the tonsils and a correction of a nasal obstruction, the symptoms subsided and the patient apparently restored to his normal condition. The adverse situation in his case is that he has not returned for a second examination, living near Harrisburg, and I have had no report except that made during the three months following the operation.

Patient number three was apparently a definite tic-douloureux, involving a period of eight years, and at the advice of a prominent internist a cystic inferior turbinate and infected tonsils were removed, and in two months the patient was apparently well. The adverse situation in her case was that three months following her operation, her husband was taken ill, operated upon and died. A nervous depression followed and the symptoms in a measure returned.

These reports are to be incorporated in a later formal study of the subject and are given in general terms without defined reference. The writer regrets that he is unable to be present at the meeting to read this report.

**"Arrested Laryngeal Tuberculosis"; "Tempero-Maxillary Abscess Following Pneumonia"; "Exostosis of External Auditory Canal." Dr. Henry S. Wieder.**

DR. WIEDER: Someone asked me what I did in trimming this case if I did not use cautery. I depend almost entirely on nitric acid. I used argyrol. In all these cases I use it routinely. Tuberculosis is not the anemic type so often described. It is much more rare to find it congested and reddened. I want to be pardoned if I make a comment on some of the methods of examination that I noticed this evening. I told you that I



considered this a tuberculous case, yet I notice men doing things which they ought not to do. If I examined cases as some of these cases were examined, I would not last long. I never touch a mirror with my hand. If you are treating syphilis or tuberculosis cases you are going to get in trouble. Take mirror and as soon as the film begins to disappear the mirror is ready to be used.

**"Case of Syphilis Involving the Nose and Pharynx." Dr. Robert Lukens.**

L. S., 38 years old, married five years; no children; no abortions. Personal history negative.

Present trouble began one and a half years ago with a sore throat. The throat was not very troublesome so she did not have treatment of any kind for it.

Four months ago she noticed an external swelling on the right side of her nose and associated with interference with breathing through the right nostril. She consulted no physician until three weeks ago when she appeared at the chest department at Jefferson Hospital. On examination there was a hard non-inflammatory swelling involving the right side of the nose and extending over the right maxilla. The right nostril was completely filled with a greyish white, friable mass, resembling cauliflower tissue, in appearance and consistency. A probe could be thrust into it for an inch and a half; nothing escaped but a small amount of blood. The throat showed destruction of part of the soft palate most extensive on the left side; almost complete destruction of the left tonsil and posterior pillar. Entire mucosa of throat greatly inflamed. Wassermann 4-plus. Absolutely denies any signs of previous luetic manifestations, chancre, rash, falling hair, etc. On December 16, Salvarsan was administered. One week later swelling began to subside. She feels much better and the slight headache that she had over her right antrum has disappeared. When I saw her today, the mass in the right side of her nose has disappeared but the destruction of her palate is still present.

DISCUSSION.

DR. EDWARD W. COLLINS: We saw a case at the Pennsylvania Hospital somewhat similar to Dr. Luken's case. The peculiar part about it was a sequestrum which remained in the nasopharynx. It was necessary to etherize the woman to take this out. The sequestrum did not slough out but after she had about eight injections of neosalvarsan.

DR. P. SAMUEL STOUT: The nostril was completely filled with substance but it disappeared so quickly. If we thought it would disappear so quickly we would not have given it.

DR. LUKENS: This patient is not cured by any means. We are going to make further studies on her.

*Regular Meeting, Tuesday, Feb. 1, 1921.*

The regular meeting of the Philadelphia Laryngological Association was held on Tuesday, February 1, 1921, Cadwalader Hall, College of Physicians, at 8:15 P. M.

Dr. Chas. R. C. Borden of Boston, Mass., read a paper entitled "Pulmonary Tuberculosis Following Nose and Throat Operations."

Discussion opened by Dr. Ralph Butler.

DISCUSSION.

DR. RALPH BUTLER: This is a most important subject and we are fortunate in having it so ably presented by the essayist of the evening.

These complications include bronchitis, pneumonia, pleurisy, abscess of the mediastinum, abscess and gangrene of the lung.

Abscess of the lung, because of its frequency as compared with other complications, is the most important, and my discussion will be upon this phase of the subject as it occasionally occurs after tonsil and adenoid

operations. I have no personal knowledge and have seen little in the literature of these complications following operations upon the nose or sinuses.

Abscess of the lung with its attending sepsis must always be considered a serious condition, but I have no personal knowledge of a fatal case, and with one exception they have recovered promptly without operation. This fact and the frequent late development of symptoms, i. e., after the patient has left the hospital, suggests the possibility of many of them going to the family physician or to another hospital and undergoing a spontaneous recovery without the knowledge of the operator. I know of several cases in which the operator heard nothing of the pulmonary complication until it was well and then the report was very casual.

Although there seems to be a steady increase in the number of cases of lung abscess following tonsillectomy, the percentage of the total operations must still be very small when we consider the vast number which are being performed. The disturbing fact is that the cases continue to appear and frequently in the hands of good surgeons who naturally must be improving in their technic. I believe that the average tonsillectomy is done much better today than ever before.

It is important to determine the relative frequency and especially the causes of these complications. There seems to be no question that lung abscesses occur more frequently both in relation to the number of operations and in toto. Until the extra-capsular or complete operation came into vogue, they were almost unknown and this fact makes a comparison of tonsillotomy and tonsillectomy worth our consideration. In both, local and general anesthesia are used, profuse bleeding and other complications sometimes occur. The preoperative conditions are similar and there is no radical difference in the after care of the patients.

In the days of tonsillotomy fewer adults were operated upon, the ether pump was not generally used, the large veins in the tonsillar fossae were not usually exposed and less infected material was expressed from the crypts to be inspired with mucus or blood into the lungs.

It is admitted that adults develop this complication more frequently than children, hence the marked increase in the number of operations on adults may be a factor in the increase of lung abscess. It has been claimed by Clendenning that the ether pump, so commonly used in recent years, balloons the pharynx and forces infected material into the lungs. I have tested three of the pumps in general use and think the pressure is too gentle and indirect to be a factor in the etiology, especially when the mouth is open during operation.

A deep septic wound containing large opened veins furnishes all the requisites for the embolic theory, therefore, the exposure and injury of the large veins and lymphatics may be an important factor. Also the infected material squeezed from the crypts by the snare or dull guillotine may be inspired.

Drs. Manges and Coakley believe that the inspiration of infected material is the usual cause and one who has seen an etherized patient struggle for breath can appreciate the likelihood of inspiring any fluid which may be covering the glottis at that time especially if the laryngeal reflex is obtunded or lost. I have seen blood in the trachea after this operation. On the other hand, Bevan, who reports ten or a dozen cases of lung and brain abscess following tonsillectomy within two or three years, believes that most of them are hematogenous; that the infection occurs at the site of operation, obtains access to a vein, is carried as a small infected embolus to the heart and is admitted through the pulmonary artery into the lung. He says, "As an argument in favor of this route, I would like to submit the fact that, in addition to abscesses in the lung following tonsillectomy, we have had several cases of brain abscess develop, some of these without any previous lung abscess occurring in the cases and others where the history was that of tonsillectomy, then a lung abscess and following the lung abscess, the development of an abscess in

the brain." This theory would seem to be supported by the following facts: (1) One of my colleagues told me of a young adult patient of his who died suddenly a few days after a tonsil operation probably from an embolus in the brain. (2) That Simpson and Noah report two cases of lung abscess occurring after tonsillectomy done in the upright position under local anesthesia (however these were tuberculous subjects). (3) That this complication does not seem to occur after ether operations on infected nasal sinuses in which it is probable that more or less infected blood reaches the pharynx if not the lungs.

Richardson says: "In spite of my depression of the patient's head through the raising of the foot of the operating table 35 inches and the use of the suction ether apparatus of the Beck-Mueller design, I have had one abscess formation. I am inclined to believe that this complication occurs in a fair proportion of cases by infection through the lymphatic and venous channels. Most of the cases that I have seen radiographed have apparently developed between the lobes of the lung—probably from the interlobular lymph spaces."

The most important phase of this question is its prevention.

Of course the patient should be thoroughly examined and carefully prepared for the operation. If this is done, many cases of pneumonia will be avoided but these precautions will not necessarily prevent lung abscesses if they are due to either of the causes mentioned. I do not know of any way of foreseeing which patients will take ether badly or bleed excessively. It is a common experience even in general surgery to have patients vomit and take ether badly regardless of careful preparation or the general condition. Often the most robust are the hardest to anesthetize and, judging from the reports and experience, most of the cases which developed lung abscess were strong young adults, apparently good operative risks. I think the ether problem is an important factor in preventing the inspiration of whatever may be over the glottis. The danger may be minimized by as light an anesthesia as possible, by having the head low, by keeping blood and mucus out of the pharynx and by giving atropin to prevent the excess of mucus which is likely to occur during the anesthesia. The use of the latter was adopted at the advice of internists and professional anesthetists.

If it should be shown that these cases are usually due to inspiration, this fact must be considered in deciding between general and local anesthesia.

As this complication starts during the operation, little can be done by post-operative treatment to prevent its complete development. Pain in the chest and cough are the earliest symptoms of lung abscess and usually occur several days before definite signs can be elicited by percussion and auscultation. At this stage, the X-ray examination is our most valuable aid in diagnosis and should be used, as bed-treatment is essential if an abscess is developing.

DR. HENRY S. WIEDER: I do not really want to discuss Dr. Borden's paper but I want to take exception to a portion of the discussion of Dr. Butler's. I am referring to abscess of the brain. I cannot conceive how you can have an embolus in the brain following a tonsillectomy in the tonsil area. Emboli are carried through the venous circulation to the heart and it would be necessary for those emboli to go to the lung and back to the heart before it can gain access to the brain. They are not large enough to let an embolus of sufficient size go to the brain. The anatomy is not properly considered. I would like to ask Dr. Dintenfuss to give us an account of some interesting cases he has seen recently.

DR. HENRY DINTENFUSS: Three weeks ago I had occasion to operate on three members of one family. They were five, seven and nine years of age. I used the La Force method. There was little or no bleeding at the time or subsequent to operation. The pulse, temperature and respirations being normal for four days, I gave the mother permission to allow the children out of doors as it was a very mild day. That night one of the

children became quite restless. The next morning she developed chills, vomited and had temperature of 106.° Examination disclosed lobar pneumonia. Fortunately there was a quick termination. It was a question in my mind whether the pneumonia was directly due to the operation or whether it was a secondary result of it incident to the exposure with lower vitality or whether a coincidence. That same afternoon we operated on two other cases, also by the La Force method, and had no complications and results were perfect. I would like to know whether in a perfectly normal case following operation, pulse, temperature and respirations being normal, just when should a patient be permitted out of doors.

DR. A. SPENCER KAUFFMAN: I had one unfortunate experience not quite a year ago, of pulmonary abscess after tonsillectomy in an adult. This patient was referred to me for tonsillectomy and the family physician had gone over the case thoroughly. There was nothing to contra-indicate the operation and patient was in the hospital for two or three days after operation. After she got home everything went a normal course, but she complained a little bit more than the average patient of soreness of the throat. As she was highly neurotic, I paid no attention to it. The throat looked all right. About the fifth day she had been out for an automobile ride, I was sent for and found she had a temperature of 101° and she complained of pain in the region of the right scapula. I listened to her chest, but could make no diagnosis. I called the family physician and he was unable to make a diagnosis for several days. Finally he made a diagnosis of lung abscess after it had ruptured into her bronchi. About four weeks after operation she died of gangrene of the lung. I had another experience of tuberculosis subsequent to tonsil operation. This case had been gone over thoroughly by an expert medical man. There was nothing about appearance or physical signs to indicate she was a tuberculous subject. A short time after operation she developed all signs of tuberculosis and evidently developed a laryngeal tuberculosis.

DR. FIELDING O. LEWIS: I have enjoyed Dr. Borden's paper very much. This complication it seems to me will occur as hemorrhage does, no matter what precautions are used. I feel that the anesthetic perhaps is a big factor. I feel that the first stage of anesthesia is best accomplished by chloroform. We have been using it almost entirely. I feel that the suction apparatus is very essential. In regard to the position of the patient—I think most Boston men operate in the upright position. I know of no Philadelphia men who do it. I had one experience in which the blood was inhaled and caused serious complications in the upright position. I feel that the position the patient is placed in following operation is important. We have a practice in putting our patients practically on the face. I personally have had as far as I know no complications of this type and cannot speak from personal experience.

DR. CHARLES R. C. BORDEN—in closing: You may have noticed, I have quoted practically no statistics. When I was invited to read this paper the first thing I did was to ask my friends to send me records of any fatal cases they may have had. Only one sent them! There seems to be a great reluctance among rhinologists to admit having had lung abscess except as they talk together personally. Just why this is, I do not know.

Some one spoke of not having seen a fatal case. I saw a dreadful case last fall which occurred in a young woman who developed lung abscess ten days after operation. She died some weeks later. I am proud to state that in the Boston City Hospital there have been performed about 2500 nose and throat operations during the past year with only one complication which was an ether pneumonia occurring in a boy who was not a good operative risk. He was transferred to us by one of the surgical services with a request that we operate upon him.

I have a case of brain abscess in the Boston City Hospital at the present time. The patient had a history of a running ear for some months. Had the brain abscess developed within a week or two following a tonsil oper-

ation undoubtedly, the operation would have been blamed for causing the brain abscess.

The question of embolus of the brain has been raised tonight. This complication must be very rare following nose and throat operations as any embolus which would arise in this field would be stopped in the lung before it reached the brain. It might occur, however, in rheumatic patients who had vegetations on the heart valves.

In talking with G. U. men, I am told there have been several cases of oil emboli in the brain from injection of mercury.

As to the three cases of Dr. Dintenfass', nobody knows what happens in such cases. It would be my guess that these children were in the incubation stage of their complication. Some time ago, I operated upon a young man for a septum. A few days later he came down with scarlet fever. Undoubtedly he was in the incubation stage at the time of operation.

The question of operation. There seems to be considerable difference of opinion in the literature on this point. In my limited experience the cases which have been operated upon, with one exception, have recovered. If they became chronic, the patient is in a very pitiable condition. There is a man in the Boston City Hospital at the present time who has had a lung abscess for more than nine months. Every morning he coughs up a considerable quantity of pus which has a very offensive odor. He not only cannot work but he is distinctly disagreeable to everyone with whom he comes in contact.

Reference has been made to the first stage of anesthesia. In my opinion it is not the first stage that is important from the standpoint of ether complications, but the last stage. If the patient comes out of the anesthetic before the operation is finished, the patient begins to gag, which is the thing I am more afraid of than anything else. Any rhinologist who continues to work while the patient is gagging simply invites lung complications, as gagging is always followed by a deep forced inspiration.

Boston men have been criticized for doing nose and throat operations in the sitting position. We believe that it is the safest position there is. First, we can see our field of operation in the natural position. Second, if we wish to rid the patient's mouth or throat from accumulation of blood, we simply bend them forward and any foreign material will fall out of the mouth. Third, we believe there is less hemorrhage in this position. The latter reason is particularly true in its advantage over the "Rose" position.

DR. GEORGE M. COATES: We have all enjoyed and profited very much by this able paper and I make a motion that a rising vote of thanks be given Dr. Borden.

The regular meeting of the Philadelphia Laryngological Society was held in Cadwaladar Hall, College of Physicians, Tuesday, March 1, 1921, at 8:15 P. M.

**Syphilis of the Mouth and Throat.** Lantern Slide Presentation. Dr. Joseph Victor Klauder (by invitation).

I will first present various slides representing chancres of the genitalia. In the majority of instances there is only one chancre present. There may, however, be more than one. Some are very superficial and look like abrasions and some go on unnoticed, while others become indurated and represent the hard chancre. The same phenomena takes place in chancres of the mouth, gums, lips, tongue and tonsils, etc. It is advisable in early lesions to make a dark illumination for the spirachete palada.

#### DISCUSSION.

DR. HENRY S. WIEDER: In the slide on chancre of the tongue, I thought I noticed two chancres.

DR. J. V. KLAUDER: Chancre of the tongue is rather rare. I cannot speak of many cases. In genital chancres, twenty per cent are multiple. Chancres of the lip are not uncommon in multiple form.

DR. H. S. WIEDER: Have you ever found chancre of the lip and gumma at the same time?

DR. KLAUDER: In the literature there are 27 chancres of the gum reported. I have very seldom seen two chancres in different localities.

DR. GEORGE W. MACKENZIE: I would like to ask Dr Klauder about gumma of the septum; he spoke of it being soft and friable. My experience has been that it is rather firm and gummy. Did you speak of it at a later stage?

DR. KLAUDER: Those that I have seen have been soft and friable. I used the word gumma in a general way, not in the sense of a tumor.

"Traumatic Mastoid (Bullet Wound)." Dr. Henry Dintenfuss.

The case I wish to present this evening is of interest because it shows that on rare occasions a complete mastoid operation may be performed without the aid of a surgeon's knife. It also demonstrates that hemorrhage from the lateral sinus is not the serious matter that we have been led to believe, and can be controlled by comparatively moderate pressure.

The history of the case is briefly this: Mrs. S. D. was admitted August 24, 1920, to the Polyclinic Hospital after having been shot by her husband twice with a revolver. One bullet entered through the ninth intercostal interspace anteriorly which was taken care of by Dr. Speese of the Surgical Service of the Polyclinic, while the other, that is which we are more interested in this evening, struck the left side of the head, clipping away in groove fashion the posterior portion of the auricle, taking a downward course completely demolishing the body of the mastoid, including the mastoid tip, and then going somewhat forward and embedding itself about three-quarters of an inch below the external auditory canal on a line with the ramus of the jaw. I saw her the same afternoon of her admission. The mastoid wound was temporarily packed. She was semi-conscious and quite restless. There was nausea and vomiting and the temperature was subnormal. The pulse was rapid and poor volume. Her condition was bad. On removing the packing, blood was seen coming out of an opening in the lateral sinus, which was exposed for at least an inch of its length. This blood was pushing its way through the defect in the mastoid through the aditus, into the middle ear, then after rupturing the tympanic membrane, appeared in considerable quantity exuding from the external auditory canal.

I found that by taking gauze strips and packing lightly into the wound, making steady pressure, that the entire hemorrhage was controlled without very much difficulty. When the splintered bone was removed a probe could very easily be passed from the mastoid area into the attic, making the situation a real mastoid operation without, of course, the associated inflammatory condition being present. Curiously enough the facial nerve and the parotid gland were uninjured. I dressed the wound every few days just as you would following the ordinary mastoid operation, shortening the gauze packing gradually. After a few weeks, the patient was discharged practically well with the exception of a narrowing of the external auditory canal which I attributed to the traumatism of the posterior canal wall.

Her hearing tests show a slight diminution of obstructive deafness, which one would naturally expect from injury to the drum head. Since it was giving her no trouble, we decided to let the bullet alone, its position being easily palpable to the finger, below the external auditory canal, in which place it can also be seen very nicely in the X-ray plate that I have brought here tonight.



DR. B. SHUSTER: I think I have one better than Dr. Dintenfass. A gentleman had seventeen children and lived with his wife thirty years, but did not speak to her, finally shot his wife. The bullet went up through the neck just at the junction of the hard palate in the base of the skull, then came out through the other side. Then came up in the orbit. She was brought to hospital, put to bed and recovered.

DR. M. E. ERSNER: I also have a case which I think will go one better than Dr. Dintenfass. The case reported by Dr. Dintenfass shows a simple mastoid. The patient which I wish to speak about is a man about thirty-eight, who decided to commit suicide on account of matrimonial difficulties. The bullet entered through the mastoid and performed a complete radical mastoid injuring the facial nerve. When the wound was first examined, the bullet appeared to be very superficial and I thought it would be a very simple matter to remove. It is, however, interesting to note the manner in which the bullet splashed through the bone and the ramifications of the projections of the bullet into the surrounding bony tissues. When I was through removing the bullet I realized that it wasn't so easy a matter as it looked.

DR. G. W. MACKENZIE: I would also like to report a case. An Italian who has shot a woman, policeman and then himself. The bullet entered either through the canal or behind the canal, followed the mastoid, into the antrum, down to the Eustachian tube. I operated to recover the ball, which was located beyond the Eustachian tube, but we decided to leave it. The patient did well. Gaynor, of New York, was shot while on a boat. The assassin shot from behind, taking a direct course down the mastoid, antrum, going into the middle ear space and down the Eustachian tube, lodging there. The patient usually spits blood. Do not operate in these cases. It is fatal if you do, as the bullet may be lodged on the internal carotid. Bleeding from the lateral sinus is usually very easily controlled by pressure. One frequently injures it during operation and very light pressure usually controls it. I think the use of wax is not essential. After several days, when you attempt to redress it, bleeding may recur. One must therefore not lose his head as simple repacking will control it.

DR. H. DINTENFASS, in closing: The use of the bone wax that I mentioned was to prevent infection of the mastoid cells by way of the Eustachian tubes, simple to block up cells properly. Newhoff and Cox use the postal stamp graft. Bone wax was used for the covering up of the mastoid cells to prevent infection.

DR. HARRY A. SCHATZ: Exhibition of Stained Sections without the Microscope, demonstrating:

1. The Comparative Thickness of the Mucosa of (a) Sphenoid Sinus; (b) Frontal Sinus; (c) Cartilaginous Septum; (d) Polypoid Inferior Turbinate:

2. The Structure of Papilloma.

3. Development of Nasal Septum in a Section from a Seven Months' Foetus.

Several additional slides of interest.

The mucous membrane inside of the nose. In doing submucous resection we all know it is fairly bulky. We all have read and some have seen what the mucous membrane in the sinuses looks like. It became rather of interest to me to see it with my own eyes and it can be readily seen without a microscope. This slide is a complete sagittal section of the frontal sinus showing fortunately a small portion of the lining mucosa turned away from the bone as a consequence that little thread of mucous membrane lying loose in the lumen. Extreme delicacy of it can be seen at a slight glance. Above it lies a slide with one or more little threads of sphenomucosa. In the frontal sinus the thread under the mucosa consists of practically one layer of connective tissue. The same thread lies in a sphenoid sinus. To compare that with the mucous membrane of the septum. That can be seen at a glance how thick it is



in comparison to the other. The slide of inferior turbinate shows a polypoid hypertrophy and of course this is mostly mucous membrane. The cyst in the slide shows the mucous membrane is particularly peeled away in one spot and one can see the thickness of mucosa. Papilloma slide—is really like a pretty flower. The cross section which looks like a flower—you can get a pretty good idea of how it looks under the microscope. Section of the internal nasal passages of a foetus that was seven months old. The only point I wanted to show you is something that I used to be taught in a submucous resection of the nasal passage—why it is difficult to elevate the mucous membrane over the ridge along the floor where the hard plate meets the septum. It was explained to me from an embryological standpoint that there are two distinct layers of mucous membrane overlapping one another. Although these two layers can readily be seen, I have brought a hand lens along as it shows it up very much better. You will readily see that space between the hard palate and the septum and a distinct separation between the cartilaginous and bony septum. I also have a section of the larynx at the level of the ventricular bands showing the false and true cords. The point I would like you to observe in the next few slides is the amount of glandular tissue. Under the microscope they are all glandular tissue. I was surprised to find how profuse they are. Section of uvula, section of soft palate showing also the masses of glandular tissue, section of posterior wall of the pharynx. I also have a section of a chronically infected tonsil that shows thick bands of fibrous tissue. These can be seen without a microscope. Also have another tonsil that does not demonstrate this infection. As you see, the septal mucosa is almost completely composed of glandular tissue.

DR. R. H. SKILLERN: I would like to offer a motion that a vote of thanks be given to Dr. Klauder for his kindness in coming to this Society this evening.

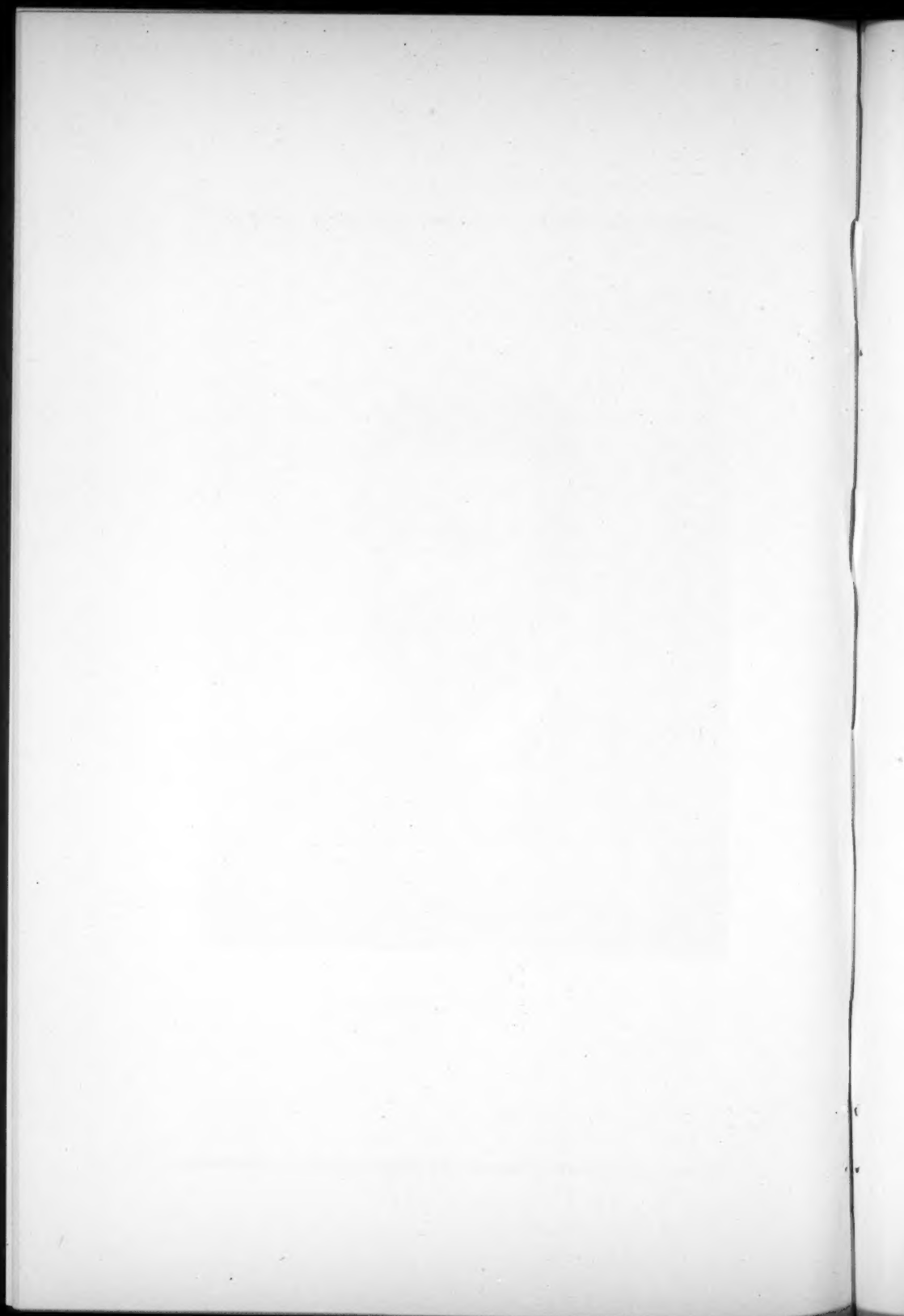
#### DISCUSSION.

DR. HENRY S. WIEDER: There is a phase, however, for those who are accustomed to looking at these under the microscope. Predominance of the inflammatory element in the tissues, the large number of eosinophiles. It is quite characteristic of all the mucosa of the upper respiratory tract. Then we find a large number of plasma cells and the mononuclear types of inflammation that is characteristic everywhere. Abundance of eosinophiles. Reference to the pathology of the nose—it is a mistake to consider the polyps as tumors when they are practically nothing but edemas and fibrous tissue.

DR. H. A. SCHATZ, in closing: These specimens were all obtained from autopsies at Blockley. I have spent a good many hours there about three years ago getting these slides.



Viktor Helander'sich



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## VICTOR URBANTSCHITSCH

Another of the venerable and respected masters in otology has passed to the Great Beyond. On June 21, last, the death was chronicled of Victor Urbantschitsch, the successor to Politzer, in the Otological Clinic of the University of Vienna.

Victor Urbantschitsch was born in Vienna in 1847, received his degree at the University of Vienna in 1870, and was named chief of the Otological Clinic of the Vienna Polyclinic in 1873, a position which he held honorably and efficiently until 1907, when he was named as the successor of Adam Politzer as Director of the Otological Clinic of the University. He received the title of Dozent in 1873, was named Professor Extraordinarius in 1885 and Professor Ordinarius in 1903.

We knew him first during his splendid activities at the Vienna Polyclinic, where his application of the Eustachian bougie, his original and valuable research in the psycho-physiology of the ear and his humanitarian and painstaking work in the acoustic training of deaf children brought him so prominently to the notice of the otological world.

Among his most interesting monographs must be mentioned "Observations Concerning the Anomalies of the Sense of Taste, Tactile Impressions and Salivary Secretions" (1870), "Acoustic Exercises for Deaf Mutes and for the Adventitious Adult Deaf" (1895), "Subjective Acoustic Phenomena and Subjective Optic Impressions"

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(1908). In 1880, the first edition of his text-book on otology appeared, and in 1910 this had reached its fifth edition.

It was our unusual privilege to work with this master at the Polyclinic and at the Oberdoebbling Institute for the Deaf in Vienna in his early investigation of acoustic exercises as applied to the development of residual hearing in congenitally deaf children.

Of all authorities who have investigated and developed this work, Urbantschitsch was the first to persist in his training of the profoundly or totally deaf child by the Acoustic Method and it was to his vision and resourcefulness that we owe the initial impetus given to the development of this special training. His text-book was characteristic of the man. It was graceful, modest and authoritative, and contained much of his original observations gleaned throughout a long service of unusually rich and abundant clinical material.

He was one of the kindest of men, a gracious gentleman with a genuine paternal interest in the ambitions and strivings of the younger men in the profession. He was a lucid, painstaking teacher and always one of the most popular members of the Faculty with the otological post-graduates in the big Austrian Scientific Mecca.

We all respected him as a scientist of unusual attainments, a gentleman of much culture and refinement, a scholar, a man with a vision, a humanitarian. He has joined the otological immortals as graciously as he lived among us with his kindly spirit and his high ideals.

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